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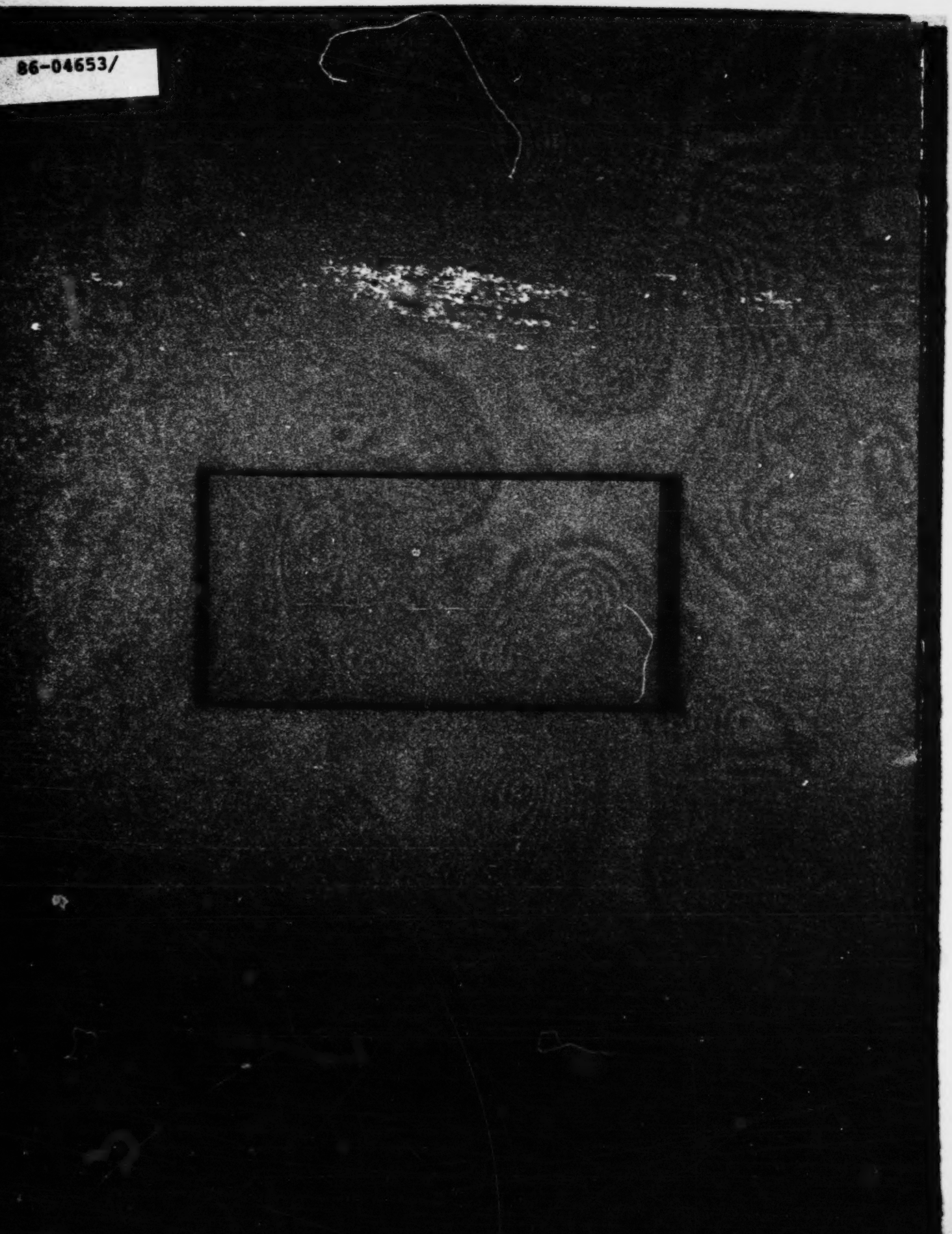

Inquiry on Federal Water Policy
Research Paper # 11

WATER IN CANADIAN HISTORY:
An Overview

by

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THE INQUIRY ON FEDERAL WATER POLICY

The Inquiry on Federal Water Policy was appointed by the federal Minister of the Environment in January of 1984 under the authority of the Canada Water Act. The members were Peter H. Pearse, chairman; Françoise Bertrand, member; and James W. MacLaren, member. The Inquiry was required by its terms of reference to review matters of water policy and management within federal jurisdiction and to make recommendations.

This document is one of a series of research papers commissioned by the Inquiry to advance its investigation. The views and conclusions expressed in the research papers are those of the authors. Copies of research papers and information on the series may be obtained by writing to the Enquiry Centre, Environment Canada, Ottawa, Ontario K1A 0H3.

Frank Quinn
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Abstract

This research paper treats the history of water, the use and development in Canada from earliest times until roughly 1960. The discussion is organized into seven sections. The first six sections correspond to specific historical periods, and attention is focused mainly on the increasingly complex relationship between human societies and their water environment in northern North America. A brief outline of some of the geological forces which shaped that environment is followed by sections treating the importance of water to Native peoples, to Canada's earliest explorers and traders, to the first European settlers in the seventeenth and eighteenth centuries, to the expanding agricultural and industrial communities of the nineteenth century, and to twentieth-century Canadian society. The final section shifts attention to the role of the Federal government in the development and management of the water resource in the period from 1850 to about 1930.

Résumé

Ce rapport traite de l'histoire de l'eau au Canada, de son utilisation et de son développement des temps les plus anciens jusqu'à 1960 approximativement. Le rapport est divisé en sept sections. Les six premières sections correspondent à des périodes spécifiques de l'histoire et l'attention est principalement portée sur la relation de plus en plus complexe entre les sociétés humaines et leur environnement hydrique dans le nord de l'Amérique du nord. Un bref profil de quelques-unes des forces géologiques qui ont généré cet environnement est suivi de sections traitant de l'importance de l'eau pour les peuples autochtones, pour les premiers explorateurs et négotiants du Canada, pour les premiers colons venus d'Europe au dix-septième et dix-huitième siècle, pour les communautés agricoles et industrielles en expansion du dix-neuvième siècle et pour la société canadienne du vingtième siècle. La dernière section porte sur le rôle du gouvernement fédéral dans le développement et la gestion des ressources en eau durant la période de 1850 à 1930 environ.

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Introduction

Water has played a fundamental role in the development of Canadian society. It is therefore useful to examine the changing nature of the relationship between human beings and the water environment of northern North America through history.

Canadian society developed in a number of distinct phases, corresponding more closely to stages of economic and technological development than to changes in constitutional structure. Accordingly, the main body of this report is divided into six sections, each corresponding to an historical period characterized by one or more distinct developments. A final section is devoted to political and administrative aspects of water development, and more specifically to the role of the federal government in the period from the 1850s to the 1930s. The contents of these seven sections will now be outlined briefly.

Retreating Glaciers

The first section will cover the period from about 20,000 B.P. (before the present) to about 6,000 B.P.: roughly the period of the retreat of the last great glacier to cover northern North America. This enormously significant geological event set the stage for the development of human societies in Canada. It went a long way toward determining the character of the physical environment -- and particularly

the water environment -- to which humans would later adapt.

Native Societies

As the glacier receded, Native societies developed in all regions of Canada. These distinct cultures made many successful adaptations to what was often a very watery environment. In the second section, I will look at Native peoples prior to European contact, in terms of how they used and regarded water.

Exploration and Early Trade

In the third section, attention will be focused on the initial phase of European contact with North America. This period, which began in either 1000 or in 1497 (depending on the stress one wishes to place on the Norse expeditions of the eleventh century), was characterized by two types of activity on the part of the Europeans: exploration, and trade with the Natives. Water routes were essential to both of these activities. Explorers' accounts can usefully be consulted as a means of gauging the Europeans' impressions of the 'New World' and its water resources, and as documentation for the origins of trade.

Settlement and Expansion

With the establishment of Québec by Champlain in 1608, the settlement phase of Canadian history can be said to have begun. Québec was not the first French outpost in North America,

but it was the first to develop into a permanent population center. The years from 1608 to 1800 saw the growth of the French agricultural colony on the St. Lawrence, as well as the emergence of important settlements in the Maritimes. They were also characterized by the growth of the fur trade into the central commercial activity of the continent. This implied the westward and northward extension of trade routes, and the discovery of new territories and water systems lying to the west.

The Nineteenth Century

The fifth section will treat the nineteenth century. In Canada, this period was characterized by population increase, westward expansion, urbanization, industrialization and political consolidation. It saw the emergence of many new industries based on water power, new cities requiring water supply, a revolution in transportation and the extension of the agricultural frontier. As eastern cities grew, more and more urban dwellers felt the need for fresh air and clean water, and the recreation potential of Canada's water resource was first realized. Quite early in the century, logging emerged as one of Canada's most important industries, particularly in Ontario, Quebec and New Brunswick. Canals were dug and later deepened all along the St. Lawrence system to facilitate communications and trade between the Great Lakes and tidewater. The steam engine emerged in both transportation and industry and played a major role in Canada's industrial revolution.

The expansion of settlement and trade into the prairie region and British Columbia was another important development of the nineteenth century.

The Twentieth Century

Canadian society had become even more complex by the beginning of the twentieth century. In one sense, if the nineteenth century was the age of coal and steam, the twentieth is that of hydroelectric power. Major projects -- intended not only to produce power, but to provide improved navigation, water storage and flood control -- were proposed and implemented on water courses all over the country between 1900 and 1960. In a real sense, Canadians no longer sought to adapt to their water environment: they sought to adapt that environment to their expanded needs. Along with the increased scale and complexity of water use came conflicts between potential uses and users. Often these conflicts took place across municipal, provincial and international boundaries. The emergence of interjurisdictional agencies to deal with this type of problem should be seen in this context. Problems associated with water pollution can also be attributed to the expansion in the variety and extent of water uses in the twentieth century, although some of these problems were already apparent to observers in the nineteenth.

The Federal Role

The seventh section will turn away from primarily social

and economic considerations, and focus on political and administrative aspects of water development. Emphasis here is squarely on federal agencies which played a role in managing water resources, and on the policies they adopted and implemented. The periodization used here is distinct from that adopted for the rest of the paper. Events which occurred in the 1850s are considered along with some which occurred as late as the 1930s. This departure was deemed necessary because the evolving federal role in water development is a topic which pertains to both the nineteenth and the twentieth centuries, and which could not be treated effectively in either section five or section six.

Section 1:
Retreating Glaciers

Water played a crucial role in Canada's pre-history. Long before the Norse excursions of the eleventh century, perhaps even before the proto-Amerindian peoples crossed the Bering Strait, huge ice-sheets advanced and receded over northern North America, shaping its environment and establishing the context for the development of human societies in this country.

Over the last million years or so, continental glaciers as much as two miles thick have invaded Canada several times In terms of its effects on the current Canadian landscape, the most recent glaciation -- known as the Wisconsin -- is the most significant.

The Wisconsin ice-sheet reached its maximum extent something like 18,000 to 20,000 years ago. At that time, Canada was almost completely covered with ice, except for an ice-free corridor east of the Cordillera stretching from Alaska to the American Northwest. This corridor may have accommodated migrating hunters from Asia at various stages of the glacial era. From this point forward, the ice gradually began to melt: a process which was occasionally interrupted or reversed as the earth's temperature cooled down temporarily. By six to seven thousand years before the present, however, Canada was virtually ice free, except for the Baffin-Ellesmere region and certain parts of the West.

The action of this most recent glacier fundamentally altered the physical environment of northern North America. As it receded, the territory which is now Canada became "a vast storehouse of fresh water, including some of the largest lakes ever to have existed in North America."[1] In mountainous areas, glacial erosion scoured basins out of hillsides; these filled with glacial melt-water to form tarns. Glacial sediments were deposited over melting stagnant ice in the Canadian Shield, giving it the rugged landscape covered in lakes and streams we know today. And broad, low-lying areas such as the Great Lakes basins were further deepened and smoothed as glacial activity excavated the softer rocks they contained.[2]

In terms of geological time, Canada's vast system of lakes and rivers is a relatively recent arrival. One glaciologist points out the effectiveness of glacial action on water networks, suggesting that

> Few lakes within the boundaries of the ice age glaciations originated earlier than the Wisconsin glaciation . . . . In fact, a good approximation of the southern limit of the Laurentide ice sheet during its last advance in the midcontinent is a line separating areas where lakes are abundant from those where no lakes exist.[3]

Canada, of course, lies entirely above such a line. Another authority states a similar case with specific reference to Canada:

> The retreat of the ice added new features to the land surface. The indiscriminately scattered morainic debris caused widespread interruption of drainage, resulting in a fantastically intricate pattern of lakes,

> large and small. The constant flow of melt water . . . left its own marks in valley trains, outwash aprons and channels . . . .[4]

These geological events of the late Pleistocene are important in historical terms because they constitute the creation of Canada's water environment. Two specific incidents in the pre-history of Canadian water are the rise and decline of Glacial Lake Agassiz -- named for an early exponent of the ice-age theory -- and the evolution of the Great Lakes system. These can be discussed briefly before attention is turned to the importance of water to Canada's earliest inhabitants.

Glacial Lake Agassiz -- on whose Manitoban shorelines, artifacts of early human settlements have been found -- began forming about 12,000 years ago when glacial melt passed an important topographical divide in western Minnesota. At its full extent, it covered 350,000 square kilometers of territory in Minnesota, the Dakotas, Saskatchewan, Manitoba and Ontario, with a maximum depth of some 200 meters. The lake, which completely covered the southern part of Manitoba, lost most of its water about 8,000 years ago. Today, its vast bed constitutes some of the richest agricultural land in Canada. Many of Manitoba's water-ways, including Lake of the Woods, Lake Winnipeg and Lake Winnipegosis, are shallow remnants of Glacial Lake Agassiz.[5]

The Great Lakes system, which is such a central axis in Canadian history, did not develop its current hydrological configuration until perhaps as recently as 2,000 years ago. According to geologist J.L. Hough, Lake Michigan's waters

still drained southward via the Rivière des Plaines and the Mississippi system at that time.[6]

In fact, the development of the Great-Lakes drainage system went through a number of stages as the last great ice sheet receded. In the first stage of the retreat of the Wisconsin glacier, "pro-glacial lakes" formed as melt water gathered between ice fronts and heights of land. All of the pro-glacial Great Lakes initially drained southward via the Mississippi, because their eventual eastward trajectories were still blocked by ice. In a second stage of de-glaciation, the Great Lakes expanded, taking on more or less their present-day forms. At this stage, however, sea levels were much higher than today; the Champlain Sea covered most of the St. Lawrence Valley; and the upper Great Lakes flowed eastward into the Champlain Sea via rivers such as the Trent and the Ottawa. It was only in the final stage of the Wisconcin de-glaciation that the Great Lakes - St. Lawrence system assumed its current configuration. In geological terms, these are very recent events indeed.

What is the significance of these earlier lake stages to the subsequent development of water-transport in Canada? They might be related to two separate eras in history: that of canoe-travel and that of canal building. Hough suggests first of all that,

> The Ottawa - Mattawa - French Rivers route was navigable for canoe travel because of its geologic history; it was at one time the outlet for drainage of the three upper Great Lakes. Likewise, the route from

> south-eastern Georgian Bay to Lake Ontario, and the Route from Lake Michigan to the Illinois River, were amenable to canoe travel because they were former dischargeways of the three upper lakes.[7]

With respect to canals, he argues that those,

> . . . of the Mohawk Valley - Lake Erie, the Georgian Bay - Lake Ontario, and the Lake Michigan - Illinois River routes were economically feasible because they were placed in natural valleys which, at one time or another, were former dischargeways of the Great Lakes.[8]

The events of the Wisconsin glaciation, then, had important effects on Canada's physical environment. Lakes and rivers were born as glacial ice first scoured the landscape and then deposited sediments and melt water in its wake. Drainage systems evolved over a period of thousands of years, and did not assume their current configuration until relatively recently. These events helped define the character of the land and water environment to which Canadian societies would later adapt.

Notes to Section 1

1. C.L. Matsch, North America and the Great Ice Age (New York: McGraw-Hill, 1976) p. 88.

2. Ibid., pp. 88-9.

3. Ibid., p. 88.

4. J. Warkentin (ed.), Canada: A Geographical Interpretation, p. 17.

5. Matsch, p. 90. See also W.J. Mayer-Oakes (ed.), Life, Land and Water. Proceedings of the 1966 Conference on Environmental Studies of the Glacial Lake Agassiz Region (Winnipeg: University of Manitoba Press, 1966)

6. Cited in J.C. LaSerre, Le Saint-Laurent: grande porte de l'Amérique (Montréal: Editions Hurtubise HMH, 1980) p. 38.

7. J.L. Hough, "The Prehistoric Great Lakes of North America," in American Scientist 51 (1963) p. 85.

8. Ibid., pp. 86-7. Some of these former spillways have been re-opened in inter-basin water-transfer projects, such as the south Saskatchewan to Qu'Appelle River diversion.

Section 2:
Native Societies

The first appearance of human beings in a North American context is a much debated issue. Most scholars now agree that the first Americans probably crossed the Bering land bridge at a point when sea levels were much lower than today. But the timing of this event remains uncertain.

One recent text-book in Canadian human geography gives 15,000 to 25,000 years before the present as the best estimate of the first arrival of human beings in Canada. Its authors suggest that the earliest North Americans possessed a very simple culture based on hunting, gathering and fishing. Archaeological evidence from the late Pleistocene establishes the presence of human settlements in the Maritimes, along the shorelines of pro-glacial lakes, and in the ice-free corridor east of the Cordillera.[1]

Five thousand years ago, Canada was physically much as it is today. It was populated, however, by a series of nomadic and semi-nomadic peoples who made remarkable adaptations to diverse but always demanding environments. The need for water was common to all these cultures, as it is to human societies everywhere. Natives needed water to drink and for cooking, as a medium of transportation and in agriculture. Water supplied the habitat for fish and water-fowl which provided food, and for beaver and other fur-bearing creatures which provided skins for warmth in winter. Watersheds were among the few territorial boundaries between tribes, and

fish and other water animals played an important part in the Natives' animistic religions. Except for the plains of the southwest and the more mountainous areas, early Canada was a "watery land."[2] Much of the social, economic and political life of its first inhabitants depended on access to water.

We can divide our look at water in Native society into several areas. Food -- including fishing, hunting, gathering and agriculture -- was obviously of critical importance. Transportation -- whether for purposes of migration, trade, hunting or fishing -- was only slightly less crucial. After considering these two areas, the political and religious significance of water in Native society can be examined.

Food

Early societies expended a high proportion of their time and energy securing food to ensure their survival. In Canada, water played an important role at many stages of this process. Diet varied a great deal between tribes and cultural groups. Few tribes however did without fish.[3] West Coast peoples were heavily dependent on the salmon runs up British Columbia's rivers for centuries before European contact. Iroquoian groups in the Great Lakes basin supplemented their agricultural economy by fishing for such species as whitefish, trout and sturgeon. And each summer, the hunting tribes of the eastern and northern forests migrated towards fishing-grounds known to them for generations.

Fishing, then, was the most obvious way in which water

helped to support human life in Canada prior to European contact. In various parts of the country, Natives developed more or less elaborate means of catching the fish which inhabited Canada's water courses. Anthropologist Diamond Jenness made an inventory of these techniques in the 1950s, using archaeological and historical evidence. He suggests that in areas of Canada other than the plains,

> . . . the fish-hook and the fish-spear, the net, trap, and weir were as indispensable at certain seasons as the bow and arrow; and dried fish was a staple food in nearly every community during the first two months of winter.[4]

Jacques Cartier, on his second voyage to Canada in 1535 took note of the

> . . . large number of huts along the banks of the (St. Lawrence) river, which are inhabited by Indians, who catch great quantities of the numerous good fish in the river, according to the season.[5]

He was also interested in the techniques used by the Natives to preserve their fish, noting that the Huron

> . . . have in their houses large vessels like puncheons, in which they place their fish, such as eels and others, that are smoked during the summer, and on these they live during the winter.[6]

Though familiar with the use of the barb, Native groups generally avoided its use on fish hooks. For set-lines, a gorge rather than a hook was used; this was a short, sharp, straight piece of wook or bone set inside a piece of meat or fish. Hooks were used for trolling or jigging. Some tribes used the eyes, skin or belly of the fish for bait; others

carved pieces of bone, ivory or stone to act as lures. Indians on both coasts jigged cod, halibut and salmon in bays and inlets; northern Indians and Inuits trolled from their canoes and jigged through the ice for whitefish, salmon and salmon-trout. Eastern tribes often fished at night, using torches and spears to catch sturgeon, salmon and eels. Also using torches, B.C. tribes speared or clubbed salmon swimming upstream; in winter, some groups set lures near holes made in the ice and speared approaching fish.[7]

All of these methods yielded few fish, compared to the vast number caught with nets, traps and weirs. Northern, eastern and west-coast Indians all used the seine, a net placed vertically in the water with floats at the top and weights at the bottom. Eastern and B.C. groups had bag-nets and dip-nets, usually used in conjunction with weirs.[8]

Jenness gives a fair amount of detail where the construction of weirs is concerned. In general, such an undertaking involved the labour of all the members of a community. For certain tribes, the importance of this communal effort cannot be overemphasized. In parts of B.C., for example, log weirs were used to trap fish which accounted for two thirds of the Natives' food supply; their destruction by floods or by enemies therefore meant disaster for a community. Similar barricades, built of piles and brush, were used by Native fishermen in the east. In the north, the Inuit trapped salmon-trout between rows of low dams made of stone. And on Vancouver Island, the Kwakiutl and Salish built U-shaped stone dams along the banks

of tidal rivers to catch salmon.[9]

Fishing, while certainly the method of food-procurement in which water was most clearly involved, was not the only such method. Water-fowl, which were abundant in early Canada, could be hunted with bow and arrow, as could beaver, otter and other water mammals. Beaver meat was probably an important food source for many tribes before Europeans became so interested in its fur. In a large sense, all hunting efforts were grounded on Canada's water resources, since the animals which were hunted needed water themselves in order to survive.

Agriculture is an aspect of Canadian aboriginal society which seldom receives much attention. Iroquoian peoples around Georgian Bay, in the St. Lawrence Valley and South of Lake Ontario grew maize, beans and squash for food, sunflowers for the oil, and tobacco to smoke. Clearly, an adequate supply of water in the form of rainfall was essential if these communities were to thrive -- as they did.

The Hurons are the Iroquoian tribe which have received the most scholarly attention in Canada. Anthropologist Bruce Trigger suggests that among the Huron, agriculture accounted for two thirds of the food eaten. The technology was of a "slash and burn" type in which the men cleared the land by using fire and stone axes to fell trees, and women planted, cared for and harvested the crops. Because of the low level of technology, light and sandy soils which could be worked easily with wooden spades were preferred. Such soils provide

good drainage, but are particularly susceptible to drought, and there was a good deal of anxiety about the possibility of such a disaster in Huron society. Drought or no drought, Huron villages had to be moved every ten to twenty years because of soil depletion; they are therefore generally classified -- with other Iroquoian peoples -- as semi-nomadic.[10]

In addition to hunting, fishing and agriculture, Native peoples gathered the nuts, fruits, berries and herbs that grew wild in their environment. The Ojibwa people, who lived north and west of Lake Superior, had a method for collecting wild rice which was observed by explorer David Thompson in the nineteenth century:

> The wild rice is fully ripe in the early part of September. The natives lay thin birch rind all over the bottom of the canoe, a man lightly clothed or naked places himself in the middle of the canoe, and with a hand on each side, siezes the stalks and knocks the ears of rice against the inside of the canoe . . . . so plentiful is the rice, an industrious man may fill his canoe three times in a day.[11]

Water was also used, in all native cultures, in cooking and as a beverage.

Transportation

Most Native tribes in Canada were essentially nomadic. Travel could be undertaken in one of two ways: on foot or on water. There were no roads and no wheeled vehicles, and the only draught animal was the dog. Rivers, lakes and streams served as important transportation links in both winter and summer. Surfaces which could be paddled across in warm

weather could be tramped across on snowshoes in cold. This ability to travel over Canada's water courses was essential to hunting, fishing, trade and warfare in Native Canadian society.

The canoe, of course, is a singular example of Native peoples' ability to adapt to their water environment. Indian canoes were of two main types: the dugout, which was carved from a single log, and the ribbed craft covered in bark or hide. Dugouts prevailed on the Pacific coast and among certain Iroquoian peoples in the east. Bark canoes -- which were light, easily repaired if comparatively frail, and which could be portaged across low watersheds without difficulty -- predominated in eastern Canada and in the Mackenzie basin. Birch was the preferred material for the outer shell; cedar ribs gave these craft their characteristic shape, and the whole was held together with the roots and gum of the spruce tree. The Inuit, of course, had their own characteristic craft: the kayak and the umiak. Only certain groups on the plains did not build and use boats of one kind or another for transportation.

By most accounts, the birch-bark canoe was the finest of all the craft built by Native Canadians. Though easily damaged, these boats could be repaired using materials commonly found alongside rivers, streams and lakes. Handled skilfully, they were well adapted to the descent of the many rapids on Canadian water-courses. In most cases, they were light enough to be carried by one man if a portage became necessary. The

best birch-bark canoes were those made by members of the Algonkian cultural group. Jenness suggests that the Iroquoian tribes living at the southern extremity of birch country often purchased canoes from the Algonkians, rather than using the heavy pine dugouts or elm-bark canoes they could make themselves. He also points to the importance of the canoe in the subsequent development of the fur trade.[12] G.P. de T. Glazebrook has also paid tribute to the birch canoe in his History of Transportation in Canada, for many years the standard work on the subject. According to Glazebrook,

> The canoe par excellence . . . was that made of the bark of the birch tree. This was an Algonquin type of canoe and was made with astonishing skill by the various tribes of the Algonquin family with the crude instruments at their command. Of paper-like thinness, the birch canoe might nevertheless last for some time under careful treatment. It combined speed and carrying capacity with extreme lightness, so that it could be carried -- "portaged" -- past unnavigable sections with comparative ease; and yet it was strong enough to stand the rapids down which it was steered.[13]

Canoe construction varied from tribe to tribe, even within a given cultural group. More substantial differences -- such as those between the bark canoes of the Algonkians and the dugouts of the Pacific Coast Indians -- represent adaptations to distinct environments. The Coastal Indians carved long, narrow dugouts from a single log, usually of cottonwood. Among certain tribes, the Haida for example, this carving could be highly ornamental. These sleek boats -- which were usually poled rather than paddled -- provided stability in the fast

but shallow waters of British Columbia's coastal rivers. Larger craft, these of cedar, were built for communication between the mainland and the islands.[14]

Some attention should be paid to the importance of water-courses as transportation links in winter, since frozen lakes and rivers were among the principal trails followed by the nomadic hunting tribes in winter. Snowshoes greatly facilitated this means of conveyance and seem to have been developed quite early, particularly by Algonkian peoples. Dogs could be harnessed to toboggans in winter and made to haul a reasonably heavy load. The Inuit dog-sled, of course, is the best known example of this type of technology.

Travel in winter was mainly for purposes of the hunt. Game had to be followed into its winter feeding grounds, and this meant seasonal migration for hunting tribes such as the Algonkians. Life was more sedentary for farmers such as the Iroquoians. Still, according to Trigger, Huron men went on long fishing expeditions in their canoes, traded maize for furs with the hunting peoples of the north, regularly visited their hunting grounds, and travelled across Lake Ontario to wage war on the Iroquois. In all cases, water was the basic medium of transportation.[15]

Political & Religious Significance

Many scholars who treat the subject consider Canadian aboriginal political structure to have been fairly loose. Normally, the largest organizational unit was the tribe,

which might consist of fifty, one hundred or two hundred families. Similarities in culture and/or language did not always translate into political affinity, a situation to which the Huron-Iroquois conflict of the seventeenth century (which contributed to the destruction of Huronia around 1650) attests. Internal political structure varied from one cultrual group to another. Most had some type of kinship -- or 'clan' -- structure; some -- such as certain Pacific Coast groups -- had class systems based on slavery.

In terms of territorial boundaries, Native communities were so spread out that it was mainly with respect to hunting grounds that this could become an issue. One student of the subject suggests that Algonkian tribes claimed something like territorial rights in "fixed tracts of country, the boundaries of which were determined by certain rivers, ridges, lakes or other natural landmarks."[16] This seems to confirm the impression given by Champlain in his account of explorations in the year 1608 when he refers to the Richelieu River as the "River of the Iroquois."[17] The same student goes on to suggest that

> In southeastern Canada, the boundaries between Indian tribes were principally watersheds. They seem to have been continued seaward to prominent coastal features, along general lines continuing the watersheds.[18]

It is beyond question that in Native society, water courses and drainage basins were among the most important geographical features. It is only natural that they should have been used-- whether formally or informally -- to delineate tribal territories.

Finally, water was important in the spiritual life of most native communities. This is not surprising, since life and death could depend on the availability of water and of the plant and animal life it supported. Among the agricultural Hurons were shamans who claimed to be able to control the weather. Some of these shamans

> . . . would predict frost, suggesting at the same time that it could be prevented if the Huron burned a little tobacco each day in their fields to honour the sky. In times of drought, others would promise to produce rain in return for public gifts.[19]

Beyond this, most tribes adhered to a form of animism, which attributed spirituality to most natural phenomena, including wind, rain, rocks, streams, plants and animals. Totemism grew out of animism and ascribed common ancestry to members of a given clan and a particular plant or animal. Water-based animals such as the turtle, the heron, the eel, the beaver and the salmon were among the totem-beings which lent their names to clans in various parts of Canada.[20] This can be taken as another index of the importance of water to Canada's first inhabitants prior to European contact.

Notes to Section 2

1. Warkentin, p. 20.
2. Ibid.
3. Exceptions here are certain Plains Indians who relied primarily on the buffalo.
4. Diamond Jenness, Indians of Canada. National Museum Bulletin no. 65 (Ottawa, 1955) p. 61.
5. H.P. Biggar (ed) The Voyages of Jacques Cartier (Ottawa: Public Archives of Canada, 1924) p. 142.
6. Ibid., p. 158. A puncheon is "a large vat of varying capacity." (Webster's).
7. Jenness, pp. 61-2.
8. Webster's defines a weir as a "fence or enclosure set in a waterway for taking fish."
9. Jenness, p. 64.
10. Bruce Trigger, The Huron: Farmers of the North (New York, 1969) pp. 26-7.
11. Quoted in Jenness, p. 43.
12. Jenness, p. 108.
13. G.P. de T. Glazebrook, A History of Transportation in Canada, Vol. 1 (Toronto: McClelland & Stewart, 1964) p. 2.
14. Jenness, p. 105.
15. Trigger, pp. 20, 30.
16. Norman L. Nicholson, The Boundaries of Canada, its Provinces and Territories (Ottawa: Queen's Printer, 1964), p. 5.
17. H.P. Biggar, (ed.) The Works of Samuel de Champlain Vol. 4, (Toronto: University of Toronto Press, 1971) pp. 74-5.
18. Nicholson, p. 5.
19. Trigger, p. 29.
20. Stanley Ryerson, The Founding of Canada: Beginning to 1815, (Toronto: Progress Books, 1975) pp. 43-45.

Section 3:
First Europeans: Exploration and Early Trade, 1500-1608

The title of this section includes an initial date which has been selected more or less arbitrarily. In fact, it is impossible to say when the first European set foot on what is now Canadian soil, although one can be reasonably sure that it was before the official "voyages of discovery" through which European monarchs sought to expand their influence and their treasuries. Nonetheless, it is primarily to the sixteenth century that the story of early exploration and trade belongs.

Exploration

Perhaps the best candidates for first Europeans in Canada came in ships from Scandinavia via Greenland. The evidence for a Norse presence in Canada in the eleventh century is quite strong. It is of two kinds: literary and archaeological. The literary evidence is familiar to most who have read an introductory Canadian history book. The "Norse Sagas" describe the adventures of Vikings such as Leif Eirikson who sailed westward from the coast of Greenland to discover a land they called 'Markland' -- meaning timberland -- and another they called 'Vinland' after the wild grapes which grew there. Both territories are likely to have been on the eastern coast of North America, although it is very difficult to be more specific.

The best archaeological evidence comes from a site in northern Newfoundland which was excavated in the 1960s. At L'Anse aux Meadows, archaeologists found the ruins of a cluster of houses, boatsheds, and a smithy complete with iron traces, all of a type consistent with Norse culture of the eleventh century. For our purposes, it is interesting (if not surprising) to note that the settlement at L'Anse aux Meadows was located on the banks of a stream.

Many historians have tried to twin the literary with the archaeological evidence. One recent student of the subject suggests that "the published data appear to be sufficient to establish l'Anse aux Meadows with little doubt as a site occupied by the Greenlanders in the eleventh century," and to further identify 'Markland' with Labrador's east coast.[1] A greater mystery surrounds the possible location of 'Vinland', a fertile land occupied by 'Skraelings' who, according to the legends, rode in skin boats, used arrows, and attempted to barter furs for arms. The Eirikson clan made attempts to colonize this land, where in addition to grapes there was excellent grassland for livestock and ". . . no lack of salmon . . . in river or lake, and salmon larger than they had ever seen before."[2]

Water -- albeit salt water -- was of crucial importance to these and all subsequent explorers of Canada, whether Norse, Portugese, Spanish, Italian, English or French. Early explorers of all nationalities had at least one thing in common: they were excellent sailors. Men like Eirikson, Cabot and

Cartier were capable of sailing long distances under difficult conditions through uncharted waters. At least through the seventeenth century, the measurement of longitude at sea was next to impossible, which explains why some of the earliest explorers thought they had reached the east coast of Asia.

Between the eleventh and the late fifteenth century there is little documentary evidence of a European presence in North America. By the latter date, however, the richness of Newfoundland's Grand Banks had become known to fishermen from England, Portugal and other seafaring nations in Europe. Fishing, in fact, was probably the primary motivation behind the "discovery" of Canada. Exploration of the waters on Canada's east coast developed at least in part as a by-product of the fishery.

There were other motives for continued exploration, however. Explorers such as John Cabot -- an Italian mariner sailing under the English flag -- was interested in finding a passage via the northwest to Cathay or, failing that, deposits of gold and silver similar to those unearthed by the Spanish in South and Central America. Cabot's official voyages in 1497 and 1498 yielded more modest results. In 1497, he sighted forests and fire-sites on the shores of what may have been Cape Breton Island, and reported to the king on the richness of the offshore fishery. In 1498, Cabot and most of his crew were drowned at sea in a second attempt to reach the North American coast.[3]

The first official explorer to penetrate any distance

into Canada's interior was Jacques Cartier, who made voyages in 1534, 1535-36 and 1541. Cartier had a lively curiosity and was an interested observer of nature. In the preamble of his report to the king of France, he gave the following summary of what he had seen in North America:

> . . . through the present expedition undertaken at your royal command . . . you will learn and hear of [the] fertility and richness [of the land], of the immense number of peoples living there, of their kindness and peacefulness, and likewise of the richness of the great river, which flows through and waters the midst of these lands of yours, which is without comparison the largest river that is known to have ever been seen.[4]

Cartier's perhaps over-enthusiastic appraisal of the St. Lawrence -- known to him as the River of Canada or of Hochelaga -- may have been influenced to a certain extent by Native accounts of its vastness. One such account was provided to Cartier by the two Indians who had returned to France with him after the voyage of 1534, in their capacity as guides for the voyage of 1535-36:

> The two Indians assured us that this was the way to the mouth of the great river of Hochelaga and the route towards Canada, and that the great river grew narrower as one approached Canada; and also that farther up the water became fresh, and that one could make one's way so far up the river that they had never heard of anyone reaching the head of it.[5]

In 1534, Cartier had only reached Anticosti Island before turning back, so that in 1535-36 most of the St. Lawrence remained to be explored.

Proceeding further up the St. Lawrence, Cartier encountered the mouth of the Saguenay, and recorded the following impressions:

> Some fifteen leagues to the west-south-west of this harbour, in the middle of the stream, lie three islands, and opposite to them there is a very deep and rapid river, which is the river and route to the kingdom and country of the Saguenay, as we were informed by our two savages from Canada. This river issues from between lofty mountains of bare rock with but little soil upon them. Notwithstanding this, a large number of various kinds of trees grow upon this naked rock, in such sort that we saw there a tree tall enough to make a mast for a ship of thirty tons . . . . At the mouth of this river we found four canoes from Canada that had come there to fish for seals and other fish.[6]

Cartier's use of the term 'Canada' in these passages is interesting. He used it as the natives used it or a similar word: to refer to the area along the St. Lawrence bounded by Grosse Island on the east and a point between Québec and Trois Rivières on the west. Like many early topographic and hydrographic names, it later became generalized to denote a much broader area. Other place names have similarly interesting histories. The name Québec, for example, comes from a native word, 'kebec', meaning "where the stream is obstructed:" appropriate since the St. Lawrence, though extremely deep, is only 3,230 feet wide at the site of Quebec City. And the name 'Hochelaga' referred to the region around the Lachine Rapids, and means "at the beaver dam" in the Huron language.[7]

Between the 1540s and the first decade of the seventeenth century, exploration of the Canadian interior and its waterways lagged, although the coastal fishery flourished. The next important explorer of Canada's rivers was Samuel de Champlain, who is generally considered the father of New France, and who spent most of his time between 1603 and the 1630s in Canada. An able geographer, Champlain had been one of the first to propose the building of a canal across the Isthmus of Panama. A skilled navigator, he was impressed with Canada's vast water resources, and particularly with the possibilities they presented for further exploration:

> It must be said also that the country of New France is a new world, and not a kingdom; perfectly beautiful, with very convenient locations, both on the banks of the great river (the ornament of the country) and on other rivers, lakes, ponds and brooks . . . a network of great rivers and lakes which are like seas lying across the countries, lend great facility to all the explorations of the interior, whence one could get access to the oceans on the west, the east, the north, and even on the south.[8]

By the time this account was written, Champlain had certainly followed the Ottawa River route to Lake Huron, and had navigated through the Trent River system and across Lake Ontario in canoes with a Huron war party. He had also heard accounts of the salt sea to the north, of the relatively easy portage from the Great Lakes to the Mississippi River system, and of the possibility of a journey through the Nelson and Mackenzie watersheds to the west coast. All of these routes would be followed by Europeans for purposes of exploration and trade

before the end of the eighteenth century. Champlain's account foreshadows by some 150 years the voyage of Alexander Mackenzie to the mouth of the river that bears his name.

Champlain's journals emphasize the abundance of waterfowl in eastern Canadian waters, and the excellence of the fishing in the early seventeenth century. Among the birds he noted on Canadian rivers were,

> . . . all sorts of ducks, teal, white and grey geese, bustards, little geese, woodcock, snipe, little and big larks, plover, herons, cranes, swans, divers of two or three kinds, coots, ospreys, curlievs, thrushes, white and grey seagulls.[9]

He further suggested, in part as an incentive to settlement, that for the fisherman,

> . . . there are rivers, brooks, lakes and ponds in as great number as one could desire, with an abundance of salmon; very beautiful trout, fine and large, of every kind; sturgeon of three sizes; shad; very good bass, some of which weigh twenty pounds . . . (etc.)[9]

The notion of the 'unlimited' character of Canada's water and wildlife resources probably has its origins in early explorers' accounts such as these.

Trade

Contact between European and Native cultures had probably been established to a certain extent by the time of Cartier's first voyage in 1534. Natives encountered in the Baie de

Chaleur had held fur pelts in the air as an inducement to Cartier and his men to come ashore. This has indicated to many scholars that these Natives had seen Europeans before and knew that they could acquire valuable iron knives and hatchets by bartering the furs which they wore. It is clear from this and other evidence that the fur trade first developed as a by-product of the coastal fishery, particularly after the shift from a "green" to a "dry" fishery -- implying the need to construct and maintain drying stages on shore -- produced greater contact with Native populations.

The fur trade emerged as a distinct economic activity in the second half of the sixteenth century. Harold Innis places this development in the context of a "revolution" in the conditions of supply and demand affecting beaver fur. In supply terms, as Natives became more and more dependent on European products, they went further and further into the interior in search of furs. In demand terms, there was a rapidly growing market for felt hats in Europe. Because it has the property of being minutely barbed, beaver fur was considered the best in the production of felt. Other types of fur found ready European markets as well, and huge profits were made by traders who exchanged tools they regarded as 'trinkets' for valuable furs.[10]

Easterbrook and Aitken suggest that the reason that the French were so pivotal in the early fur trade was the they could not make any headway against mainly English competition in the coastal fishery. Driven up the St.

Lawrence, the French encountered Natives who were interested in acquiring the iron and copper implements which could make their lives so much easier, and whose only marketable commodity was fur. These economic historians argue that the fur trade developed slowly in the period 1500-1550 because the French were mainly in contact with Natives of the Iroquoian cultural group, which got its sustenance mainly from agriculture and fishing. They suggest that the pace of the trade quickened once contact with the Algonquin and Montagnais peoples of the Saguenay region was made. Sometime after 1540, these hunting peoples probably drove the Iroquoians -- such as those whom Cartier had encountered at Hochelaga in 1535 -- south of the St. Lawrence, so as to establish control of the important St. Lawrence - Ottawa route to the interior. These Native groups, it should be emphasized, already controlled the Saguenay, which was among the most important arteries used in the early trade. Easterbrook and Aitken summarize the situation in the second half of the sixteenth century as follows:

> The principle [routes] to the interior [were] now controlled by hunting Indians, highly skilled in trapping beaver and familiar with the best hunting grounds. While the English continued to dominate the richer regions of the fisheries and the mainland to the south, French influence was pushed steadily along the St. Lawrence and Ottawa in pursuit of the beaver.[11]

This push along Canada's rivers and lakes towards the interior, and the generally westward extension of European influence as it followed the 'beaver frontier' was to be a constant theme in Canadian history for the next 250 years.

The role of water in this story was, of course, central. Fresh water represented, first and foremost, the only suitable medium for the transportation of goods in any quantity over long distances. As suggested earlier (Section 2), Algonkian peoples made excellent canoes; these were well adapted to their journeys into the interior in search of new sources of fur. Water was also the habitat of the principle article of commerce, the beaver. Its sedentary habits, and its construction of readily identifiable dams and lodges in the water meant that it was easily located by the experienced Native hunters. The explorer David Thompson has evoked the further advantages accruing to these hunters on the basis of their acquisition of European technology:

> Formerly, the Beavers were very numerous, the many Lakes and Rivers gave them ample space, and the poor Indian had then only a pointed stick shaped and hardened in the fire, a stone Hatchet, Spear and Arrowheads of the same; thus armed he was weak against the sagacious Beaver who on the banks of a Lake made itself a house of a foot thick or more; . . . . But when the arrival of the White People had changed all their weapons from stone to iron and steel and added the fatal gun, every animal fell before the Indian . . . .[12]

Against the new fashion for felt hats in Europe, the huge profits which the French traders could count on, and the technological revolution represented by the Natives' acquisition of iron and steel weapons -- ultimately including guns -- as well as other manufactured goods, the peaceful, industrious beaver didn't stand a chance. The second half of the six-

teenth century saw the beginning of the quasi-systematic slaughter of this species, starting in the St. Lawrence and its tributary basins, and moving relentlessly westward via the St. Lawrence, Ottawa and Saguenay routes over the next several hundred years -- at least until beaver hats gave way to silk in the European marketplace in the nineteenth century.

Initially, it was the Natives who did most of the travelling. In the early years, they brought furs from previously untapped sources to trading posts, generally located at the mouths of rivers. Tadoussac, at the junction of the Saguenay and the St. Lawrence had sufficient anchorage for ocean-going vessels, and was the most important French trading post of this period. Natives would travel substantial distances, often portaging over heights of land to get there. Champlain describes the Natives of the St. John River basin travelling by water and over land to trade at Tadoussac in the first decade of the seventeenth century.[13]

By this time, certain tribes were acting not only as producers in the French fur trade, but as middlemen. Certain Algonkian tribes living in the Saguenay basin -- notably the Montagnais -- had begun to acquire French trade goods on credit and transport them into the interior for the purpose of trading with tribes living in other drainage basins. These Natives were initially unwilling to allow Frenchmen to accompany them on their trading missions because they felt that their lucrative position as middlemen might be jeapordized. Champlain's curiosity about the various routes to the interior --

a curiosity steeped in the long-standing search for a "Northwest Passage" -- was not to be left entirely unsatisfied. But he was often forced to rely on Native accounts such as the following elicited from the middlemen on the Saguenay route:

> The savages reported to me that after passing the first fall they pass eight others; they then go on a day's journey without meeting any, and again pass ten others and enter a lake [Lac St. Jean] which takes three days to cross; and they can easily make ten leagues a day upstream. At the end of the lake there are tribes who lead a wandering life, and three rivers which empty into this lake, one coming from the north very near the sea, where they consider it to be much colder than in their country . . . . This is the region to which our savages go with the merchandise we give them to exchange for the furs which the others have, such as beaver, marten, lynx and otter, which are found there in large numbers and which they then bring to our ships [at Tadoussac]. These northern tribes tell our savages that they see the salt sea, and if that be true, as I think it certainly is, it can be nothing but a gulf entering the continent through the northern regions.[14]

Through Native accounts of their trade routes and their contact with other tribes, Champlain had correctly guessed at the character and location of Hudson Bay, independently of Henry Hudson's voyage in 1610.

Notes to Section 3

1. David B. Quinn, North America from Earliest Discovery to First Settlement: The Norse Voyages to 1612 (New York: Harper & Row, 1977).

2. Leif Eirikson's Saga, quoted in Ibid., p. 27.

3. Quinn, pp. 119-121.

4. H.P. Biggar (ed.), The Voyages of Jacques Cartier (Ottawa: Public Archives of Canada, 1924) pp. 90-91. There is some question as to whether Cartier was actually the author of his Voyages. From some of the syntax, it would appear as if another officer may have been responsible for keeping the ship's log, on which the accounts are based. Nonetheless, citations from Cartier's Voyages are here attributed to Cartier, primarily for purposes of smoother exposition.

5. Ibid., p. 106.

6. Ibid., pp. 113-4.

7. Ibid., p. 103, n. 68; p. 107, n. 88; p. 128, n. 76.

8. E.G. Bourne (ed.), The Voyages and Explorations of Samuel de Champlain (1604-1616) Narrated by Himself (Toronto: The Courier Press Ltd., 1911) p. 3.

9. Ibid., pp. 6-7.

10. H.A. Innis, The Fur Trade in Canada: An Introduction to Canadian Economic History (Toronto: University of Toronto Press, 1930, 1956) pp. 10-15.

11. W.T. Easterbrook & W.T. Aitken, Canadian Economic History (Toronto: The Macmillan Co., 1965) p. 40.

12. Cited in Innis, pp. 5-6.

13. Bourne, p. 79.

14. H.P. Biggar (ed.) The Works of Samuel de Champlain (Toronto: the Champlain Society, 1932), pp. 41-2.

Section 4:
Settlement & Expansion, 1608-1800

This section is meant to cover the period from the founding of Québec to the turn of the nineteenth century. These years saw the implantation of agriculturally-based settlements in the St. Lawrence Valley, Acadia and later, Upper Canada. They also saw the westward extension of the fur-trade frontier, primarily via the Ottawa River-Georgian Bay route, but after 1670 from Hudson Bay as well. Both settlement and the expansion of trade were dependent on the availability of water: most obviously to drink, in food preparation and for local and long-distance transportation, but also in a number of other important ways. Water was used as a source of power for grinding grain and sawing boards in new France and Acadia; the emergence of this type of water-based technology in the early settlement period will receive a good deal of attention here.

Beginnings

The beginning of the settlement phase of Canadian history is generally dated from the establishment of Québec by Champlain in 1608.[1] One could perhaps more appropriately begin an account of settlement in the year 1604, when a French expedition led by Pierre du Gua, Sieur des Monts attempted to pass the winter on an island in the mouth of the Ste. Croix River on the Bay of Fundy. The disastrous results of that attempt are

well known: 35 of the would-be settlers did not survive the winter. As a result, the settlement had to be relocated, and in 1605 des Monts founded Port Royal in Nova Scotia's well-sheltered Annapolis Basin.

Port Royal was an early attempt to establish an agriculturally based settlement in North America. An historian of water-power in the United States, L.C. Hunter, suggests that for such a settlement to become viable, one of the earliest and most fundamental needs was for an efficient means of grinding grain into flour.[2] Port Royal was in this respect no different from the American frontier communities studied by Hunter. By March 1607, des Monts' colonists had begun the construction of a water-powered gristmill on the Lequille River, which was to be the first of its kind in North America.[3]

The settlement at Port Royal, however, lay fallow between 1607 and 1610 because the Sieur des Monts had lost his Royal Charter. It is for this reason that Québec is generally considered the first permanent French settlement in the New World.[4]

Champlain, in his account of the first autumn spent at Québec, describes some of the preparatory work which had to be done in order to establish a settlement. The first tasks were the clearing of land for agriculture and to obtain wood for building. On July 3 1608, Champlain chose for his settlement

> . . . the point of Québec, so called by

> the savages, which is covered with nut-trees and vines. I at once employed a part of our work-men in cutting them down to put our buildings there, another part in sawing planks, another in digging the cellar and making moats, and another in going to Tadoussac with the pinnace to fetch our effects . . . .
>
> While the carpenters, sawyers and other workmen were busy at our quarters, I set all the rest to clear the land about our buildings to make gardens in which to sow grains and seeds, in order to see how they would all succeed, since the soil seemed to be very good.[5]

Such were the beginnings of the colony which grew up on the banks of the St. Lawrence and its tributaries between 1608 and 1763.

Settlement

Agricultural economies such as those which developed in New France and Acadia needed water, as already suggested, for a wide variety of reasons. Water-powered mills were used to grind grain for food and to saw boards for shelter. Water remained the most important means of transportation; the colonists not only adopted the canoe, but began to construct European-styled boats, including small bateaux, medium-sized sailing ships for navigation on the Great Lakes, and large sea-going vessels for use in the king's navy. Access to water was also important with respect to settlement patterns. Habitants considered it important to have river frontage on their concessions: hence the characteristic elongated shape and riparian orientation of Québec farms. And water-based natural resources were important, since most settlers

fished and hunted to supplement their diet.

Mills

Two of the primary needs of any pioneer economy were gristmills and sawmills. Hunter argues that in the United States,

> Gristmills and sawmills were among the first community facilities obtained in frontier areas, in most regions taking precedence over schools, churches, and stores and coming well in advance of wagon roads.[6]

In Canada, things were much the same. Without the benefit of a gristmill, grinding grain was a long and strenuous process, usually involving some form of mortar and pestle. Similarly, the boards required for building could only be obtained at the expense of a substantial amount of labour prior to the arrival of the sawmill.[7]

Clark (1968) suggests that "two gristmills (one water and one wind) and a second water mill, doubling for grinding grain and sawing wood" were in operation in the Annapolis Valley by the late 1680s.[8] Marcel Trudel counts nine wind-powered gristmills in the St. Lawrence Valley in 1663, and four water-powered mills.[9] Clark suggests that the wind-powered mills were in a sense superior to water mills because the latter type were occasionally put out of production by droughts. This may explain the predominance of windmills in early seventeenth century New France. Alternatively, the geography of the Quebec City region, where most of the mills were located, may have rendered the operation of wind-powered

mills less costly.

On this subject, Clark cites the accounts of two French travellers who visited Port Royal shortly before it was ceded to the English, and gives further evidence of the importance of water-powered mills in Acadia:

> Dièreville also reported three mills, describing one as for grinding corn and two as for the sawing of timber, and locates them on the stream south of the settlement. Villebon mentions boards from Port Royal, and says they had two sawmills and four water mills for grinding grain. Certainly there were mills up the river; Pierre Thibodeau, who established the first settlements at Shepody, had been a miller at Pré Ronde. Moreover, these mills were turning out a good deal of flour to supply the garrison and visiting ships, and even for trade.[8]

It is useful to point out that any time a barrel of flour is mentioned in historical documents of this period (and well into the nineteenth century), one is forced to think in terms of gristmills for the production of the flour itself, and of sawmills for the production of barrel staves -- not to mention the sawn lumber used in the construction of the ships used to transport the flour. Bread, of course, was much more important in the European diets of the seventeenth and eighteenth centuries than it is today. And water entered the production of a loaf of bread at almost every stage.

With respect to the importance of sawmills in New France, Fauteux suggests that the Jesuits had one in operation at Québec in 1646, if not before. Sawn lumber became more important as the settlement grew. It was needed for floors,

roofs and household furniture in particular. In 1646, the Jesuits hired one E. Bougoust "comme charpentier et pour aider au moulin." In 1650, the governor conceded to the Ursuline sisters a plot of land known as "rivière du moulin à la planche," and later christened "rivière à la scie," strongly indicating the presence of a water-powered sawmill on the site.[10]

Jean Lunn has summarized the principle uses of wood in colonial Canada. In addition to being the most important construction material, "Wood had also to be supplied for boats, barrels, furniture, sleighs, carriages and so on." Wood was cut in the winter by the habitants; it was then either used by the habitant himself or sold to a miller, who might have a contract in town to supply lumber for a particular purpose. Wood was so widely used in New France that by 1713 certain seigneuries had been stripped of trees, and additional grants had to be made for timber supply. The number of sawmills in the colony increased from 10 in 1716 to 70 in 1739, a period during which the population approximately doubled.[11]

Peter Kalm, a Swedish naturalist who toured New France in the last decade of the French régime, gives a description of the residence of the Governor of Montreal in 1750. The residence was located on an island in the St. Lawrence, where there was also a water-powered gristmill in operation. Kalm's colourful account is worth quoting at some length:

> This morning I accompanied the governor,

> Baron de Longeuil, and his family to a little island called Madeleine, which is his own property. It lies in the St. Lawrence River directly opposite the town on the eastern side. The governor had there a very neat house, though it was not very large, a fine, extensive garden, and a yard. The river passes between the town and this island, and is very rapid. Near the town it is deep enough for large boats, but towards the island it grows more shallow, so that they are obliged to push the boats forward with poles. There was a mill on the island, turned by the mere force of the stream, without an additional mill-dam. In the mill I noticed that the stones did not consist of one single piece but were made of several pieces. The upper millstone was quite large, made of eight parts which were joined very close together and bound with a thick iron band. The lower stone was the same. The upper one had been imported from France but the other was native . . . . The wheels and axle were made of white oak, but the cogs of the wheel and other parts of the machinery were made of sugar maple or wild cherry. Still, the former was said to be the most in use, because it was considered hard wood, especially if it had grown in dry places.[12]

Kalm also described the seigneurial mill operated by the Sulpician Order in Montreal at mid-eighteenth century. This must have been a comparitively large mill, since the seigneurie of Montreal comprised the entire island, and because the droit de banalité obliged the censitaires to have their grain ground at the seigneurial mill in exchange for a certain proportion of the flour thus obtained:

> The priests of Montreal have a mill where they take the fourth part of all that is ground. However, the miller receives a third part (of the seminary's portion) for his share. . . . The mill is built of stone with three waterwheels and three pair of stones.[13]

The other side of the droit de banalité was that the seigneur was legally obliged to build a mill for the use of his censitaires. In the seventeenth century, many seigneurs failed to comply with this obligation, with the result that -- as suggested earlier -- there were only 13 gristmills in the colony by 1663, when it was incorporated as a Royal Province of France. Furthermore, many of these mills were operated by enterprising habitants who received seigneurial authority to build and operate a mill, rather than by the seigneur himself.[14]

Cole Harris has suggested that the reason the seigneurs were slow in setting up gristmills was that the initial outlay for a mill was high, and that there was no guarantee of a return on the investment unless there were at least 25 families living on the land. In 1667, the gristmill banalité was fixed at one fourteenth of the grain ground: a rate much lower than that observed by Kalm at Montreal eighty years later. Legislation was passed in 1686 obliging the seigneur to build a mill within a year of taking possession of his land, or forfeit the droit de banalité. Harris argues that from the seigneur's standpoint,

> The construction of this mill was his principle seigneurial expense. The largest of them, like the stone mill on Terrebonne, which was one hundred and twenty feet long and forty wide, three stories high and fitted with granaries on the top floor, and four pairs of water-powered millstones below, or a similar mill belonging to the Séminaire de Québec at Petit Pré in Beaupré, probably cost the seigneurs at least 10,000 livres.[15]

Even the smaller mills, which might from the outside resemble small farmhouses, could cost as much as 2,000 livres to build.[15]

By 1688, there were 44 gristmills in New France -- 31 more than the number counted by Trudel in 1663. Harris suggests that about half of these were profitable to the seigneur. With population expansion in the first half of the eighteenth century, the number of mills in the colony grew apace, not least because as the seigneuries filled up, the operation of a mill became increasingly lucrative. After 1700, complaints about seigneurs' failure to build mills died down; by the end of the French régime, "Very few settled seigneuries were without a mill, and some had four or five."[16]

Transport

Water as a means of transportation remained vital in the settlement phase of Canadian history. Ocean-going ships would generally sail up the St. Lawrence as far as Québec, where a shipbuilding industry was begun in the 1660s under Talon's intendancy. Various kinds of bateaux -- a term which covers many types of vessels, from simple rowboats to sloops and barques -- were constructed for the navigation of the trickier waters between Québec and Montreal. Canoes, of course, were the mainstay of the fur trade. Although the French did make efforts to navigate the upper St. Lawrence in bateaux in this period, fur transport was cheaper by canoe on the Ottawa than by boat on the Lakes. Habitants used

canoes to take their produce to market and to visit neighbours; they also used the rivers for winter-time transportation, travelling in sleighs or on snowshoes.[17] More attention will be paid to the question of water-transportation when discussion turns to westward expansion later in this section.

Land Use

Settlement patterns in New France generally followed the St. Lawrence, except where it was broken by tributaries. Seigneuries and rotures (individual concessions) were granted along the St. Lawrence and its navigable tributaries in the form of "long, narrow trapezoids," so as to allow maximum river frontage for all concerned. Harris -- who is the foremost historical geographer of New France -- explains the general pattern of agricultural development:

> With approximately forty inches of rain a year everywhere in the colony the tributaries were not needed for irrigation, but many provided power for saw or gristmills, water for stock, and water for household use. When a tributary was navigable, and access to it from the land was easier than to the St. Lawrence, settlement often followed its course, and seigneuries were conceded along the most important tributaries as they were along the St. Lawrence.[16]

Fishing

For the habitant, particularly if -- as most did -- his land bordered on a water-course, fish represented an important dietary item and a possible source of additional

revenue. Eels were particularly abundant in the St. Lawrence in September and October, and the river also yielded such species as salmon, sturgeon, carp and catfish.[18]

Censitaires were generally allowed to fish for subsistence in the waters bordering their rotures without fear of seigneurial exactions, a right which was confirmed by the Governor Lauson in 1652. But the seigneur extracted a profit from any commercial fishing the habitant might venture. In the suburbs of Québec, fishermen were required to give one twenty-fifth of the eels they caught to the Compagnie des Cents-Associés, seigneurs of the region at the time. Rates varied from one seigneury to another, usually between one thirtieth and one eleventh of the catch, and the species most often taken commercially were eels and salmon. Certain religious communities had special privileges with respect to the St. Lawrence fishery. In the mid-seventeenth century, for example, Québec's Hôtel-Dieu enjoyed a monopoly on commercial fishing in the mouth of the St. Charles River.[19]

Industry

Though it is ignored in most accounts, there was a good deal of craft-based industrial development in New France, much of it involving the exploitation of water resources. Fauteux suggests that there were two main periods of industrial growth during the French régime: Talon's intendancy (1665-68; 1670-72) and that of Hocquart (1735-1745). Talon succeeded in establishing a brewery, a tannery, and manufactories engaged

in the production of cloth, hats and shoes. In addition,

> . . . il fait exploiter des pêcheries et les forêts. Il construit des vaisseaux, envoie à la découverte des mines, entreprend la manufacture du gourdon et de la potasse.[20]

After a period of decline in all these sectors, shipbuilding was revived under Hocquart, the exploitation of forests increased, the number of sawmills multiplied, and the fisheries prospered.

It remains to be pointed out that such establishments as tanneries, breweries, forges -- such as the one built on the St. Maurice River in the 1730s -- and textile mills made abundant use of water, primarily as a source of energy to drive machinery, but also as a process input and as a means of waste disposal.

Expansion

Westward expansion and exploration in this period occurred primarily in the context of the development of the fur trade. Between 1608 and 1760, the French expanded their trading empire over a vast portion of the North American interior, spanning the St. Lawrence, Nelson, Mississippi and Mackenzie drainage basins. Challenges to this empire were not infrequent. In 1653, the Iroquois succeeded in cutting off the vital Ottawa route entirely, so that no furs were sold at Montreal that year. In 1670, the English established the Hudsons Bay Company as a means of competing with the French for the trade of (what is now) western Canada. And in 1759, the French Crown lost

the ultimate struggle to maintain its interests in Canada with the defeat of Montcalm at Québec. This left the St. Lawrence-Great Lakes route, and the Ottawa-Georgian Bay route open to the English, who already controlled the northerly approach via Hudson Bay. After the Conquest, the Northwest Company was quick to capitalize on the upstream flow of merchandise and the downstream flow of furs which had fuelled the growth of Montreal -- the crucial trans-shipment point -- during the French régime.

Eric Morse has pointed out the rather extraordinary extent to which Canadian waters are navigable by canoe:

> The really amazing feature of Canadian geography . . . is the amount of fresh water in Canada: half of the world's fresh water surface. The rivers are not only closely connected but, for a portable craft adapted to the interrupted navigation, are entirely navigable.[21]

As suggested earlier, it was the Natives who did most of the travelling in the early fur trade. After the establishment of Québec, the Ottawa River - Georgian Bay route emerged as the key to the fur trade of the western interior. Champlain himself explored this route in 1615, probably the first European to do so. With the aid of Huron Indians, the French began transporting trade goods -- which were as yet new, unfamiliar, and certainly extremely valuable to the hunting tribes of the west -- up the river, and canoe-loads of furs downstream. Initially, the Hurons benefitted greatly from their position as middlemen, but in the end it cost them dearly. By the mid-seventeenth century this tribe had been virtually destroyed

by Iroquois groups who were probably armed with English guns, and who sought to control the Ottawa on behalf of their allies based in New York. After 1660, the French established "new connections" among the Native tribes, strengthened the garrison at Montreal, and as a result, were able "to defeat the Iroquois and gain firm control over the route."[22]

French fur-trading developed along the Ottawa River route for a number of reasons. Most importantly, it was shorter and better adapted to canoe-travel than the St. Lawrence - Great Lakes route; it was also less susceptible to interference from the Iroquois and the English. In the seventeenth century, small posts were erected along this route for purposes of local trading. But its chief importance throughout the French régime and for a number of decades afterwards was as a means of access to the Upper Great Lakes, and from there to the river systems of the prairies.[23]

Beyond the Great Lakes there were a number of possible routes into the west. The principle route used by the French led from what is today Thunder Bay by the Kaministiquia River to Rainy Lake, and from there via the Rainy River to Lake of the Woods. After 1670, of course, the English began establishing fur-trading posts on the rivers flowing into Hudson Bay. Throughout the eighteenth century, there was competition between the trade which flowed out through the upper Lakes, the Ottawa and the St. Lawrence, and that which flowed through Hudson Bay. The late-eighteenth century rivalry between the Hudson

Bay Company and the Northwest Company based in Montreal was the result of this competition between two trade routes. There was also a difference in approach to the fur trade. While the Montrealers established long lines of communication with the interior, the Hudson Bay Company remained at their posts, offered better prices for furs, and had the Native trappers come to them. It was because of the high transportation costs involved in a continent-wide fur trade based on canoes that the Montreal-based fur-trade declined in the early nineteenth century.

The ease with which access to the west was acquired by Europeans in the seventeenth and eighteenth centuries should not be exaggerated. Day to day life on long-distance canoe trips was extremely demanding, as the French coureurs de bois and later the voyageurs in the employ of the Northwest Company found out. Still, there were only two watershed divides to impede canoe travel between Georgian Bay and the Mackenzie River system. This meant that French fur traders needed only reliable canoes and strong men to expand their interests well into the western interior of Canada.

Notes to Section 4

1. Easterbrook and Aitken treat this date as the beginning of the French attempt to control the fur trade of the St. Lawrence.

2. Bread, of course, is a basic need of any community. See L.C. Hunter, A History of Industrial Power in the United States vol. 1 "Waterpower in the Century of the Steam Engine" (Charlottesville: The University of Virginia Press, 1979) p. 3.

3. Andrew Clark, Acadia: The Geography of Early Nova Scotia to 1760 (Madison: University of Wisconsin Press, 1968) p. 79; Canada Water Year Book, 1975, p. 7.

4. The Royal Charter granted the holder exclusive rights to the fur trade in a given region in exchange for the obligation to promote settlement.

5. Biggar (ed.), Works of Champlain, p. 49. A pinnace is "a light sailing ship used largely as a tender," -- or a supply ship (Webster's).

6. Hunter, Industrial Power, p. 3.

7. In the absence of a sawmill, many early pioneer homes went without floors.

8. Clark, Acadia, p. 178.

9. Marcel Trudel, Les débuts du régime seigneuriale (1974), p. 194. Sawmills do not appear to have been included here.

10. J.N. Fauteux, Essai sur l'industrie au Canada sous le régime française (Québec, 1927) p. 173.

11. A.J.E. Lunn, "Economic Development in New France, 1713-1760," Ph. D. Thesis, McGill University (Montreal, 1942) p. 219.

12. Peter Kalm, Travels into North America (London, 1772) vol. 2, p. 407.

13. Ibid., p. 532.

14. Trudel, Régime seigneuriale, pp. 191-3.

15. R.C. Harris, The Seigneurial System in Early Canada: A Geographical Interpretation (Madison, 1966) p. 72.

16. Ibid., p. 75.

17. Ibid., p. 12.

18. Ibid., pp. 163-4.

19. Trudel, Régime seigneuriale, p. 195.

20. Fauteux, Essai sur l'industrie, p. ix.

21. Eric Morse, Fur Trade Routes of Canada / Then and Now (Ottawa: Minister of Supply and Services, 1979) p. 27.

22. Innis, The Fur Trade in Canada, p. 43.

23. Glazebrook, A History of Transportation, p. 13.

Section 5:
The Nineteenth Century

The nineteenth century saw a number of general developments in Canadian society which had important effects on the use of water. This was the period in which the continental character of the Canadian territory was established, and in which political control over the northern half of North America was consolidated through the formation of the Canadian state. In demographic terms, it was a century of unprecedented growth, both through natural increase and through immigration, and one which saw the concentration of population in cities of expanding size and economic complexity.

Related to urbanization was Canada's industrial revolution. Some time after 1850, this country emerged in a definitive way from an age of "wood, wind and sail" to an age of "steel and steam". It is perhaps this context of industrial transition which best accounts for the expanded scale and variety of water uses in the nineteenth century. Among other important developments related to water, this period saw the emergence of steam power in industry and transportation, and the execution of the first large-scale engineering projects for various purposes -- including improved navigation and urban water supply. It also saw important developments in Canadian resource extraction industries, particularly logging, and in manufacturing -- particularly in the large cities of the east. Water remained

vitally important to farmers. With the decline of wheat production on the seigneurial lands, Upper Canada emerged as Canada's breadbasket -- to be superceded at the turn of the twentieth century by the prairies. Finally, the attractions of Canada's system of lakes and rivers did not escape the naturalists of the Victorian Era, who made ample use of them for purposes of recreation.

The most appropriate way to sort out these developments is to take a "problematic" approach. In this section, five separate problems associated with the increasing scale and complexity of water use in the nineteenth century will be examined. Individual attention will be paid to the need for reliable urban water supplies, to the importance of water in transportation, to the industrial use of water, to the role of water in the expansion of Canadian agriculture and to the new importance of water-based recreation. All of these problems are best understood in relation to the three dominant societal trends of the period: demographic growth, industrialization and urbanization.[1]

Water Supply

Canadian cities underwent unprecedented growth in the nineteenth century. As in any society, the concentration of large numbers of people in relatively small areas raised questions of water suppy. In Canadian towns prior to the mid-nineteenth century, water for domestic use had been secured from private and public wells, and from carters.

Wells and water vendors were common features of pre-industrial towns, not just in Canada, but in Europe as well.

In rural areas, water supply was not a problem where settlement was located near a river or stream -- as it usually was. Later arrivals, who were often unable to acquire land close to shore, made use of Canada's ground-water supply. Nineteenth century settlers in Ontario dug wells, normally to a depth of six to eight metres. They used a number of methods for drawing the water, including pumps made from hollowed out logs and activated by a rod and a leather plunger, and the familiar rope and windlass arrangement with a bucket at one end of the rope.[2]

F.W. Robins, in his The Story of Water Supply, alludes to an ancient technique for drawing water which was in use in colonial New Brunswick and Nova Scotia. This method employed a shaduf, which consisted of

> . . . an upright post on which was balanced a "cross-tree" arrangement or beam, having at one end a counterpoise weight and at the other a water vessel - in ancient times an earthenware pot.[3]

Robins attributes the presence of the shaduf in New Brunswick and Nova Scotia to the early influence of the French colonists. If this is the case, one might assume that similar arrangements had been in use in New France.

But it is really to the growing cities of the nineteenth century that the story of expanding water-supply requirements belongs. To take Montreal as an example, census figures show that this city doubled in size between 1825 and 1844, and did

so again between 1844 and 1861. Between 1825 and 1871, Montreal grew up from a town of 22,000 to a city of over 100,000. Its population would continue to expand at a similar rate will into the twentieth century. Eastern Canadian cities more generally went through an important growth phase in the period between 1840 and 1900. Associated with this growth was the recognition of the need for reliable urban water supplies.

The first public water works in Canada were built in St. John, New Brunswick in 1837. St. John was a port town specializing in the timber of the St. John River basin; its merchants profited from lively harbour-front activity. But there were sanitation problems associated with this activity which the early implementation of a public water-works system may have helped alleviate. An historian of New Brunswick, W.S. MacNutt, suggests in discussing the early nineteenth century that the port of St. John conveyed a pleasant impression from a distance,

> . . . but towards the wharves where scores of vessels lined up for traffic on the ocean and the river, filth became excessive and the summer sun raised unpleasant stenches.[4]

Surely a municipal water supply and sewage disposal system went a long way towards relieving this problem.

The transmission of disease through impure water was a recurrent problem in nineteenth-century Canada. Cholera ravaged British North America in 1832 and 1834, and there were serious typhoid epidemics in the 1840s and 1850s. The need for a safe source of drinking water was one of the main

reasons for the development of municipal water supply systems in Canada. The question of organic waste disposal was also increasingly pressing as cities grew more and more crowded. In pre-industrial times, the only "conveniences" of this nature were night buckets and privy-pits. In cities, nearby streams often served as open sewers in which many types of waste collected. Such was the case with Montreal's St. Pierre River in the eighteenth and early nineteenth centuries.[5] The notion that "the most satisfactory and economical method . . . for disposing of the organic wastes of a community is by the water-carriage system"[6] was only just emerging in mid-nineteenth century Canada.

Following the establishment of public water-works at St. John, major cities in the rest of eastern Canada followed suit. Public water-works were instituted in Toronto in 1841, Halifax in 1848 and Montreal in 1857.[7] In 1860, Canada had six municipal water supply systems, and one more had been added by the early 1870s. Between 1870 and the turn of the century, the development of urban water systems took off. In 1880, there were 30 such networks in Canada; by 1890, that number had increased to 105, and again to 235 by 1900.[8]

The increased need for municipal water supplies was related to industrialization as well as to urbanization. A student of the subject pointed out in 1911 that

> Such establishments as sugar-refineries, starch factories, bleaching and dyeing houses, breweries, chemical works, and various other factories require an abundant water supply, and in some cases a high degree of purity.[9]

Just these types of industries were being established in Canadian cities in the second half of the nineteenth century. Other industrial needs included water for steam boilers, and for hydraulic elevators. The most important public use of the emerging municipal water supplies was in extinguishing fires. Canadian cities also used water for cleaning streets, in public buildings and in fountains.

Transportation

The nineteenth century saw at least two -- possibly three -- developments in the history of Canadian transportation which can be classified as "revolutions". The first was the construction of a series of canals for military and commercial purposes in eastern Canada. The second, concurrent with the first, was the application of steam power to river, lake and ultimately ocean navigation. The third -- which will receive the least attention here although it was in the long run the most important -- was the construction of railroads.

All three of these developments required water. The use of steam engines involved the mechanical application of the expansive property of boiling water. In this light, even the railroad boom, which began in the 1850s and culminated with the completion of the CPR in 1885, can be seen as the development of a water-based technology. Our concern here, however, is primarily with canal-building, with steam navigation, with the context in which these phenomena appeared,

and with their economic and social consequences.

Water transport had always been the basis of Canadian commerce. On the strength of its location at the head of navigation on the St. Lawrence and at the confluence of the two principle routes to the interior, Montreal had already emerged as the principle centre of Canadian commerce by the beginning of the nineteenth century. According to one theory of Canadian economic development, the initial "staple" product transported along this route -- furs -- gave way to Upper Canadian wheat and flour in the 1820s. While canoes had been well-suited to the transportation of furs, and continued to be the mainstay of the fur-trade of the western interior, the new commodities required larger conveyances -- such as "Durham Boats", bateaux, and later, steam-powered barges -- if they were to be profitably hauled eastward for export. In a word, this meant canals.

Such were the economics of the situation in the 1820s and 1830s, the first great phase of canal building in Canada. The geography of the situation has been summarized by Glazebrook in his History of Transportation:

> . . . the great waterways of Canada are tantalizingly near to being perfect for navigation, but there exist enough breaks in the chains of lakes and rivers to make it impossible to follow the natural waterways for more than limited distances. It was natural, therefore, that attempts should be made to facilitate, by means of canals, the passage of the St. Lawrence and Ottawa rivers, both on the central lines of French communication.[10]

Interestingly, there is a military context to be established as well. British North America had been the site of some border skirmishes during the era of the Napoleonic Wars, which are usually referred to as the War of 1812. Britain and the United States were anything but comfortable allies in the first decades of the nineteenth century. For Britain, the painful Revolutionary War was too recent a memory, and American egalitarian ideas and aggressive entrepreneurship were not to be trusted.

George K. Raudzens has emphasized the impact of defense considerations on the construction of Canadian canals between 1815 and 1825. He suggests that the original proposal for a canal to bypass the Lachine Rapids, made in 1814, was part of a military scheme to provide an alternative to the vulnerable St. Lawrence route between Monteal and Kingston, and was not originally intended as a spur to commercial navigation. This alternative route -- incorporating the Ste. Anne's Lock, the Ottawa River Canals at Carillon and Grenville, and the Rideau Waterway -- was completed in 1834 through the efforts of Colonel By and the Royal Engineers, at a cost far exceeding preliminary estimates. According to Raudzens, this was definitely not the waterway needed to open up Great Lakes commerce to Canadian ports.[11]

Plans to canalize the St. Lawrence route were supported by mercantile interests throughout British America. Lower Canadian merchants saw the possibility of diverting the agricultural produce not only of Upper Canada, but of the American

midwest through Montreal -- a possibility which rested on the construction of canals along the Upper St. Lawrence and between the Great Lakes.

If the context in which canal-building occurred is to be fully understood, some attention should be paid to the other "revolution" in transportation of the early nineteenth century: the advent of steam navigation.

The first steam-powered vessel to ply Canada's waters was the Accommodation, launched by John Molson's St. Lawrence Steamboat Company in 1809. The ship boasted a six horsepower engine and averaged 4½ miles per hour in its maiden voyage downstream from Montreal to Quebec. This type of performance did little to assure the public of the solid future of steam navigation.

As the application of steam-technology to navigation improved, more and more stern and side-wheeled vessels appeared in British North America. Molson's second vessel, the Swiftsure was launched in 1811. It had a 28 horsepower engine, which made it powerful enough to sail upstream from Quebec to Montreal -- something the Accommodation had been unable to do. Molson added three further steamers to his fleet between 1811 and 1818. By the 1820s and 1830s, steamboats were commonly used on the St. Lawrence, both for freight and passenger service.

Steam navigation was developing on the Great Lakes and on the Ottawa River as well. In 1816, the first steamer built for the lakes was launched at Kingston. Three years

later "The Ottawa" became the first steam-powered vessel to navigate on the river of the same name.

The commercial implications of this new form of transportation were quickly appreciated by British North American merchants. As early as 1816, the Québec Gazette would report that

> The Steam Boats have already ruined the prospects of the old River Craft, many of which long ago ought to have been condemned as unfit to receive the property of the merchant.[12]

But steam-boats could not negotiate the Lachine rapids, or the series of rapids between Lake St. Louis and Prescott -- much less the old portage route around Niagara Falls. If there was to be a "commercial empire of the St. Lawrence" based on the trans-shipment of Western agricultural products using comparitively reliable steam-power, canals had to be built. And they were.

There is inadequate time or space available to provide anything but a sketch of canal construction in British North America in the first half of the nineteenth century. The general framework -- that canals were necessary to the expansion of east-west trade in this period -- has already been established. The first attempts to improve communications on the St. Lawrence occurred in the late eighteenth century. Between 1779 and 1783, the Royal Engineers built a series of 4 canals to overcome the three sets of rapids between Lake St. Louis and Lake St. Francis. Two of these were replaced in 1804 by a single canal; in 1817 their width was doubled, and

their depth increased to 3½ feet, ". . . to admit Durham boats and bateaux capable of carrying a hundred barrels of flour."[13] These canals were replaced by the Beauharnois canal, built on the south shore between 1842 and 1845, which was 11¼ miles long, and had 9 locks with 9 feet of water on the sills. This canal was in use until the construction of the Soulanges canal in 1899.

Further up the river, navigation was interrupted by the Long Sault rapids. Here, construction of the Cornwall Canal was begun in 1837, but interrupted by the rebellion and by economic depression. When completed in 1843, the Cornwall Canal gave a nine foot channel around the rapids. Three further canals on the upper St. Lawrence were constructed in the late 1840s. Known as the Williamsburg Canals, these were less urgently needed, since steamers were in any case capable of overcoming the last set of rapids between Montreal and Kingston.

Some attention should be paid to the Lachine Canal, which was built to eliminate the need to haul goods and people across the southern tip of Montreal island from the port to Lachine by wagon. The idea for such a canal had been presented during the French régime, but it was not until 1824 that the first Lachine Canal was completed. Built by the Lower Canadian government at a cost of over £ 100,000, the original canal was nine miles long and had seven locks with five feet of water on the sills. The canal was improved between 1843 and 1848 to provide im-

proved navigation and facilities for the generation of hydraulic power. The new canal had five locks, each 200 by 45 feet. The three upper locks had nine feet of water, while the lower two had sixteen, "in order to allow the largest ocean going vessels to enter the first basin of the canal."[14] The canal was enlarged again in 1871, and gave way to a new Lachine Canal at the turn of the twentieth century.

Another crucial link in the Great Lakes to tidewater route was the Welland Canal. Like the other canals in what is now the St. Lawrence Seaway, this one has undergone many changes since it was first built in the early nineteenth century. William Hamilton Merritt's Welland Canal Company built the original canal between 1824 and 1829, largely in an attempt to offset the effects of the new Erie Canal on the St. Lawrence trade. This canal had a series of forty wooden locks and 9 feet of water on the sills. In 1840, the wooden locks were replaced by 27 stone locks, and the channel was deepened to 10½ feet. Further changes and improvements were made in 1871 and 1887, when the depth of water reached 14 feet.

The consequences of canal-building and of the emergence of steam navigation were perhaps not as profound as the merchants and promoters of the age had hoped. By 1850, a new revolution in transportation was underway which would eventually link the country from coast to coast, enabling grain and other products to be transported faster, more efficiently and over

greater distances. Nevertheless, the canalization of Canadian rivers was an important stage in the development of the country's water resources for purposes of navigation.[15]

Industry

It has already been suggested that water was important to Canada's industrial development in the nineteenth century. For one thing, the sheer volume of water used in Canadian industry expanded as the country's economy emerged from the mercantile period into the age of industrial capitalism. For another, Canadian businessmen found a wide variety of new uses for what was clearly one of the country's most valuable resources.

Canadian industry will be divided into two large sectors -- resource extraction and manufacturing -- for purposes of this discussion. A good example of a nineteenth-century resource-extraction industry which made abundant use of water (aside from agriculture, which will be discussed separately) is logging. Attention will be focussed on the logging industry in early nineteenth-century New Brunswick, Quebec and Ontario. Later, discussion will turn to the development of manufacturing industry in Canadian towns in the period after 1850. Manufacturers used water as a source of energy, as a process input, and as a means of disposing of their waste products. Certainly, many modern-day pollution problems had their roots in the industrial transition of the later nineteenth century.

Logging was important in the St. John and Mirimachi basins of New Brunswick, in the Saguenay and St. Maurice basins in Québec, and -- perhaps above all -- along the Ottawa River in the early nineteenth century. The chief market for Canadian timber in this period was the shipyards of the Royal Navy in England. Cut off from her traditional Baltic sources, England fell back on the forest reserves of her colonies in North America during Napoleon's Continental Blockade (1806-1815). This was a boon to entrepreneurs in both Upper and Lower Canada, and in New Brunswick -- at this time still a distinct colony.

The importance of the timber trade in places like the St. John and Ottawa valleys and in the Saguenay cannot be over-estimated. Nor can its impact on the water-courses which were followed into the interior in the search for oak and pine stands, respectively to provide hulls and masts for English ships. According to one historical geographer who has studied the timber trade and its impact on New Brunswick, ". . . the timber trade transformed the colonial environment of eastern Canada."[16]

This student, Graeme Wynn, is also a good source on the importance of water to the early timber trade. He points out that logging was essentially a winter-time occupation, and that ". . . the lumberers relied upon the melting streams and rivers to float their timber to market in the spring."[17] He also refers to the various ways in which loggers would attempt to modify stream-flow to suit

their needs, most of which involved the use of dams:

> Sometimes streams were prepared for driving during the summer or early fall. As in Maine, dams were built to raise the spring water level along the smaller brooks and upper reaches of larger rivers. Many of these were substantial constructions, as much as seventeen feet in height. By fitting a dam with gates or sluices, water could be backed up and timber run down the system almost as through a set of locks. Alternatively, the drive might be accomplished by "blowing" or demolishing a series of simple dams as the wood moved downstream.[18]

Other modifications to New Brunswick's rivers included blowing out large rocks with dynamite, building sluices around falls and removing dead trees and other debris. Similar techniques were applied in Ontario and Québec in this period. In 1851, for example, the government of the United Canadas allocated $40,000 for the improvements to the St. Maurice River for logging purposes, "c'est à dire à la construction d'éstacades à billotes et de glissoires." By 1859, $218,100 had been spent on anchor piers, booms and slides at Trois Rivières, Les Grès, Shawinigan, Grand Mère and Latuque.[19]

In the Ottawa Valley, Philemon Wright drove his first timber raft downriver to Québec in 1807. Many picturesque accounts of the exploits of lumberjacks and raftsmen of this region exist. One recent description stresses the skill required by the raftsmen to guide rafts -- which were made up of up to 5,000 sticks of squared timber (pine and oak) worth some $170,000 -- down the Ottawa:

> Navigating these rafts was an art that called for special skill and strength. The raftsmen, headed usually by an Iroquois or a French Canadian, had to know how to take full advantage of wind and current; and when to hoist their primitive sails or to use their oars. It was a thrilling sight to watch one of these great rafts approaching and passing a stretch of rapids . . . . The timbers, captive yet flexible, would groan and grind together as they rose and fell on the surging water, speeding along at a breakneck pace, and barely escaping being torn asunder by the rocks in their path.[20]

After mid-century, the British market for colonial timber fell off, but logging remained an essential industry because of a growing market for sawn lumber in the United States.

The nineteenth century saw the expansion of British interests into the prairie and Pacific Coast regions of Canada. Much, if not all of this expansion was inspired by the wealth of the natural resources of the west. The first important western staple industry was, of course, the fur trade. There was still a market for beaver and other types of pelts in nineteenth-century Europe, and from the 1820s onward the Hudson's Bay Company dominated the trade of the western interior. Western rivers such as the Nelson, the Saskatchewan and the MacKenzie were now the locus of an industry which continued to rely on Native and French Canadian labour. The company's charter had assured its control over all lands drained by rivers flowing into Hudson's Bay. Rupert's Land, as this territory was called, came to consist of a string of fur-trading posts scattered across vast flatlands peopled chiefly by Natives. Little European settlement occurred

before Confederation, partly because of the H.B.C.'s narrow definition of its interests. Company policy, the isolation of the region, and its shortage of navigable waterways all mitigated against settlement, which would not occur to any important extent until after the coming of the railways. When settlers did arrive in the later nineteenth century, towns generally grew up on the sites of former fur-trade posts.

The fur resources of western Canada attracted traders from overseas in addition to those who travelled across the continent. The origins of the Pacific Coast trade can be found in the late eighteenth century. At approximately the same time as traders from the Canadian interior successfully extended their reach beyond the continental divide, explorers such as Captain James Cook began to establish trade links with coastal Indians. These Natives provided the seafaring traders -- including Americans, Englishmen, Spaniards and Russians -- with valuable furs -- such as that of the sea otter -- which could be sold at an enormous profit in China's ports. In the early nineteenth century, competition between British, American and Russian trading companies in the Maritime fur trade of the Pacific Coast was rife. Initially attracted by the profitability of the fur-trade, many Europeans remained in the area to exploit its rich salmon fishery -- thus reversing the pattern observed three hundred years earlier on the Atlantic Coast.

Other resources besides fur were to be found in the west, including the forestry and mineral reserves of British Columbia. For the most part, large-scale exploitation would not come until

the turn of the century. But the Fraser River gold rush of the 1850s was an important exception. Bruce Hutchison has described the character of the rush, which brought an influx of prospectors -- mostly American -- to the shores of the Fraser River:

> On every bar men were rocking, panning and sluicing. Every creek emptying into the Fraser was explored. Wherever prospectors found a fragment of float, a hunk of gold-bearing sand fallen from some bench above, they followed the lead into the hills.[21]

He also points to the potential for conflict between miners and Natives, who still used the Fraser River for fishing and as a fur-trade route.

Later in the century, another gold rush transformed the economy and geography of the Yukon River watershed. This was the great Klondike rush, which reached its peak in the summer of 1898. At this point Dawson City, which had grown up at the confluence of the Klondike River and Bonanza Creek near the point where George Carmack had staked his discovery claim in 1896, achieved a population of some 20,000 souls, most of them miners and prospectors. The value of placer gold mined in the Yukon increased from $300,000 in 1896, to $10,000,000 in 1898. Production continued to increase until 1900, as more effective means of extracting the alluvial gold deposits were found. The value of gold mined in the Yukon in that year reached $22,000,000.[22]

The mining of placer gold in the Yukon was complicated by the fact that the gravel beds in which the deposits were to be found, and the dirt and organic material (known as "muck")

which covered them were frozen year round. Various means of thawing the earth were adopted. The earliest miners simply built a series of wood-fires during the winter. In this fashion, they thawed out one or two feet of material at a time, gradually sinking a shaft to the alluvial deposits near bedrock. Once "paydirt" was reached, the material was piled in a dump near the stream, to be sluiced in the spring. This was often accomplished with the aid of a dam constructed upstream for the purpose of diverting water through a flume to a series of sluice boxes. Large quantities of water were diverted from streams wherever placer gold was mined. This was particularly true in the Yukon where exploitation of this mineral resource took place on such a large scale.

In the cities of Canada's east, in the meantime, manufacturing industries employing increasingly advanced production technology were emerging. The really "revolutionary" features of the industrial transition included the subdivision of the labour process into its composite tasks and the development of machine-tools to perform these tasks mechanically. L.C. Hunter has pointed to the erroneous character of the assumption that the application of steam-power was the crucial turning point in industrial development:

> The key innovation in the Industrial Revolution was the mechanization of hand operations and the use of mechanical power to drive the machinery. The kind of power adopted was a secondary consideration; the choice depending chiefly upon such basic factors as availability and cost.[23]

Hydraulic power was cheap and available in nineteenth century Canada, particularly after the canalization of the St. Lawrence, Ottawa, Rideau and other systems created a whole series of dams and locks which offered convenient direct-drive water-power sites. This form of industrial energy had been in use since the French régime, but it acquired a whole new importance in the early phases of the Industrial Revolution. Hunter suggests that

> Falling water was the chief source of stationary power at all levels, in most branches of industry, and throughout the greater part of the United States before the 1860s.[24]

There are very good reasons to believe that the same was true in Canada. Industrialization along the Lachine Canal, for example, depended to a large extent on the power generated by its locks. The first lock in the system was made available to industrial users in 1847. It was capable of generating enough power to run 80 pairs of mill-stones. By 1850, all twenty water-sites in the first basin of the Canal had been leased to the owners of flour mills, iron foundries, sawmills, shipyards, and paint and drug manufactories. By 1854 with the opening of the second lock, Lachine Canal power was also being used in the production of rubber footwear, cotton textiles, woolens, joinery (particularly doors and windows), furniture, barrels and axes.[25]

Industries which required water as a process input included breweries and distilleries, which were legion in nineteenth century Canada and which often developed in con-

junction with gristmills. Here was a means of putting the coarser grains and the surplus of the better grains to good use. Paper-making also involved quantities of water, and although the forest-based pulp and paper industry did not emerge until the turn of the century, there were primitive paper mills employing a variety of materials -- such as rags and straw -- as early as 1804.

The problem of industrial wastes polluting Canada's waters probably first emerged in the later nineteenth century. Although there is little literature on the question for this time period, it is safe to say that the quality of the water adjacent to industrial areas -- particularly in cities such as Montreal, Hamilton and Toronto -- had begun to decline by the 1860s.

The 1860s also saw the beginning of the "high period" of steam technology in Canadian industry. Water-power was a good way to run a factory; but there were only so many water-power sites available in the manufacturing centres. Steam engines, in the meantime, were becoming smaller, more affordable and cheaper to run. Much of the industrialization of the period 1860-1900 was accomplished on the basis of steam technology and coal trasported from Pennsylvania or Cape Breton. There were no appreciable coal deposits in what was already Canada's principle centre of population and industry: the Great Lakes - St. Lawrence basin. There were however, abundant water resources which had been widely applied in the early phase of industrialization and which would come to the fore again at

the turn of the century with the development of hydro-electric technology.

Agriculture

Above all, the story of Canadian agriculture in the nineteenth century is a story of westward expansion. "Western Canada", however, has meant different things at different points in history. From the coming of the Loyalist settlers in the 1780s through much of the nineteenth century it generally referred to Upper Canada, the Red River Colony (established 1812) notwithstanding. Afterwards, particularly once the great transcontinental railways were built, the settlement frontier moved further west, and the agricultural potential of the prairie region began to be realized. While agricultural settlements in Upper Canada and Manitoba were generally well-watered, farmers in Saskatchewan and Alberta often had to develop the irrigation potential of the rivers and streams which flowed across the prairie in order to make their land productive.

Upper Canadian agriculture was well underway almost as soon as the first Loyalist settlers arrived in the wake of the American Revolutionary War. As in Lower Canada, the fields cleared by these pioneers rarely needed irrigation. However, water was required for domestic use, for stock, for transportation, and as a source of energy to grind grain and saw boards.

The first gristmill in Upper Canada was built by the

colonial government on the Cataraqui River near Kingston in 1782-83. Many of the settlers brought steel coffee-mills which could be used to produce a coarse flour. But, according to Hunter,

> "Coffee-mill flour seldom made good bread," and most settlers managed to get fairly good milled flour "even if they tramped thirty miles for it."[26]

Early Upper Canadians carried grain over long distances, by bateau or canoe, on foot, or by sled in winter to have their grain ground at the Kingston mill.

The number of gristmills in Upper Canada multiplied as the good farming land was settled, and communities often grew up around mill-sites. In the canal-building era, many new mills took advantage of the hydraulic power generated as a by-product of improved navigation. By 1836, there were 600 gristmills in Upper Canada, most of them run directly by falling water.

The multiplication of flour-mills in early nineteenth-century Ontario reflects the emergence of an agricultural population whose economy was geared to the export of bread-stuffs. Between 1812 and 1860, the province's population grew from 75,000 to 1.4 million, primarily because of the richness of its soil. In 1867, 60% of the population was engaged in agriculture. For at least one economic historian, the strength of the Ontario wheat staple in the early nineteenth century was the basis for that province's subsequent viable and sustained industrial growth.[27] The importance of Ontario

wheat to Canadian commerce more generally is reflected in the fact that in 1850, wheat and flour represented some 78% of the total tonnage passing down the St. Lawrence canals.[28]

The emergence of agriculture in the prairie west was a phenomenon of the late nineteenth century. Prior to the 1850s, areas such as southern Alberta failed to attract settlers, and agriculture developed on a very small scale, chiefly in support of fur-trading posts.

The pessimistic Palliser report of the 1850s did little to encourage settlement on the western grassland. Palliser thought the area bordered by the South Saskatchewan River, the American frontier and the Rockies to be "mostly unsuitable for cropping" inasmuch as the land "generally lacked tree growth, and had limited water supplies and shortgrass."[29]

After Confederation, the situation in the west changed. New studies were commissioned by the government of Canada -- which acquired Rupert's Land from the Hudson's Bay Company in the 1870s -- to assess the agricultural potential of the prairies. The Macoun report contradicted Palliser -- who had seen the land during a period of drought -- and indicated that only 5% of the prairie was unsuitable for agriculture. This was grist for the mill of the government and the CPR, both of which had an interest in establishing a chain of settlements from coast to coast, not least as a means of checking American expansion into the northern prairies.

By the 1870s, American cattle interests had already begun establishing ranches in southern Alberta and Saskatchewan. These cattlemen had been pushed west and north by settlement in the American midwest, and were attracted by Canadian grasslands. Partially in order to consolidate their hold on the territory, the Canadian government passed the Dominion Lands Act in 1872, which authorized homesteading in the prairie region. Government and CPR policies were designed to encourage rapid settlement; in most regions, settlement followed the completion of the trunk rail lines into a particular area.

In the beginning, irrigation schemes were used by ranchers and farmers alike. The year 1878 saw the first recorded irrigation development in what is now Alberta. In that year, a farmer named John Glen diverted enough water from Fish Creek to irrigate his 20 acre plot near Calgary. The first recorded diversion in the Cypress Hills area occurred in 1888, when C.W. Sanders dug a ditch from Hay Creek to land southwest of Hay Lake. By 1895, seven irrigation schemes are known to have been operating in this region. These early diversion projects

> . . . were rudimentary in nature, consisting essentially of a structure in the channel to divert streamflow and a short ditch to carry the water to the land to be irrigated . . . . Few materials were involved; the main cost of the works was the labour invested by the operator . . .[30]

The need for irrigation in certain parts of Western Canada was not always acknowledged in the seats of power. During the 1880s, the Department of the Interior and the CPR

opposed official recognition of the need for irrigation in any part of the prairies because they felt it would discourage immigration. Widespread droughts in 1885 and 1889 made this sort of obstructionism futile and irresponsible. By 1890, settlers had realized that the moist conditions of the 1870s were not the norm, and had achieved a new awareness about the need for irrigation in the west. Through lobby groups such as the Irrigation League of Alberta, farmers began to pressure the government into changing its policies with respect to irrigation.

This pressure bore fruit with the passage of the Northwest Irrigation Act in 1894. This act established the concept of publicly administered irrigation districts -- although few such districts were viable before the turn of the century. The act also incorporated two important principles of Canadian water law which would act as precedents in subsequent legislation: ownership of surface waters was vested in the crown, and their use became subject to government license. Future development of western rivers and streams for purposes of irrigation would proceed on this more structured basis.[31]

Recreation

In modern Canada, recreation constitutes an important dimension of water-use and water management. In the nineteenth century, when urban-industrial society was new, water-based recreation was only just emerging. Previously,

fishing and hunting had been more closely associated with sustenance than with leisure, and boating had been a vital means of communication rather than a source of pleasure.

As the cities of the Victorian age became more and more crowded, and as industrial occupations became more and more monotonous, many people began to seek outdoor relaxation -- much of which involved a new sort of exploitation of Canada's water resource.

Between 1850 and 1900, a voluminous literature extolling the attractions of Canada's water-courses for the sportsman emerged. Some of these books and pamphlets were written with the intent of attracting immigration; others were pure travel literature, designed to allow a largely British readership to enjoy vicariously such natural wonders as Niagara Falls.

One such book was W.A. Adamson's Salmon Fishing in Canada, written in 1860 by an English parson resident in Canada. It was designed in part to encourage emigration to "the provinces of Great Britain lying in North America beyond the Atlantic wave." Above all however, Adamson was a sport fisherman. His enthusiasm for the attractions of Canada's inland waters knew few bounds; nor did his rhetorical flights, as the following passage will illustrate:

> Think of this, ye anglers, who have been all your lives pacing the margin of some over-fished river in England! - think of this, ye perservering labourers on the well-beaten waters of the Tweed, the Tay, the Eak, the Don, the Spey, the Ness, and the Beuly! - think

> of this, ye tired thrashers of the well-netted streams of Erne, Moy and Shannon! think that within less than a fortnight's steaming from your hall doors, there are as yet twenty-five virgin rivers in one small portion of Canada, [the north shore of the St. Lawrence below Quebec City] and that of the ten which have been tried, they have all, with one single exception, been found not only to abound in salmon, but to afford ample facilities for taking that noble fish with the rod and the fly.[32]

Adamson had one reservation about salmon fishing in Canada, and it is an interesting one because it illustrates the kind of conflict between uses which makes water-management necessary today. He suggests, with a good deal of regret, that salmon fishing west of Quebec had been virtually destroyed -- with the exception of a single stream, the Jacques Cartier -- not through over-fishing, but because of the profusion of mill-dams which made no provision for the passage of salmon upstream to their spawning grounds:

> No man in his senses will say that in a young country any obstruction should be thrown in the way of the erection of mills; but every man of reflection will grant that where they are built the rivers should not be so completely blocked up as to prevent a single salmon from ascending them.[33]

Adamson proposed the construction of salmon-leaps on rivers, particularly in Upper Canada. Supposing a mill-dam fifteen feet high, he suggested the erection of ". . . two boxes, each five feet high, one over the other, to enable the salmon, in three leaps, to reach the waters which nature prompts him to seek for the propagation of his species."[34] By his

calculations, such works could be constructed below the average Upper Canadian mill-dam for a sum not exceeding twenty dollars.

Though it is not clear whether Adamson's proposals were acted on, they serve to illustrate the competition between water users -- in this case between millers and their customers and recreational fishermen -- which was already apparent in the 1860s. With the multiplication of uses in the second half of the century, and the rise in the proportion of Canada's water which was being put to one use or another, the potential for conflict between users inevitably increased. In the twentieth century, government became more and more involved in sorting out the claims of the interested parties in these sorts of disputes.

Notes to Section 5

1. In the cases of agriculture and transportation, one might certainly add a fourth "fundamental trend": territorial expansion.

2. R. Kochi & D. Munchee, "Ontario's Quest for Clean Water," in Legacy 12:3 (summer, 1984) p. 23.

3. F.W. Robins, The Story of Water Supply (Oxford: Oxford University Press, 1946) p. 41.

4. W.S. MacNutt, New Brunswick, A History: 1784-1867 (Toronto: MacMillan 1963) p. 212.

5. It is today an enclosed sewer running below St. Antoine street.

6. F.E. Turneaure, H.L. Russel, Public Water Supplies: Requirements, Resources and the Construction of Works (New York: John Wiley & Sons, 1911) p. 13.

7. Canada Water Year Book (1975) p. 19.

8. D. Tate & D. Lacelle, "Municipal Water Use in Canada," Canadian Water Resources Journal 3:1 (spring, 1978) pp. 61-78. This trend, of course, continued into the twentieth century.

9. Turneaure & Russel, Op. Cit., p. 13.

10. Glazebrook, History of Transportation , p. 72.

11. George K. Raudzens, "The Military Impact on Canadian Canals, 1815-25," Canadian Historical Review 54:3 (September, 1973).

12. Quoted in Glazebrook, History of Transportation, p. 68.

13. G.W. Stephens, The St. Lawrence Waterway Project (Toronto: Warwick Bros. & Ruther, 1930) p. 264.

14. Ibid., p. 263.

15. Unwittingly, the canals introduced another problem which would not be fully understood until well into the twentieth century: biota transfer. The sea lamprey is a good example. Responsible for severe damage done to populations of lake trout, whitefish and chub in the Great Lakes in the 1940s and 1950s, this species was introduced to Lakes Ontario and Erie in the later nineteenth century via the Erie and Welland Canals.

16. Graeme Wynn, Timber Colony: An Historical Geography of Early Nineteenth-Century New Brunswick (Toronto: University of Toronto Press, 1981) p. xi.

17. Ibid., p. 54.

18. Ibid., p. 64.

19. Normand Lafleur, La drave en Mauricie des origins à nos jours: histoire et traditions (Trois Rivières: Editions du Bien Public, 1970) p. 31.

20. Ontario, Department of Lands and Forests, Renewing Nature's Wealth (1967) pp. 37-9.

21. Bruce Hutchison, The Fraser (New York: Rinehart, 1950) p. 55.

22. Adam Shortt, Canada and its Provinces vol. 22 (1914) p. 633.

23. L.C. Hunter, History of Industrial Power p. 151.

24. Ibid., p. 159.

25. Gerald Tulchinsky, The River Barons: Montreal Businessmen and the Growth of Industry & Transportation 1837-53 (Toronto: University of Toronto Press, 1977) pp. 221-8.

26. Hunter, History of Industrial Power. Internal citations are from E.C. Guillet, Early Life in Upper Canada (Toronto, 1963).

27. John McCallum, Unequal Beginnings: Agriculture and Economic Development in Quebec and Ontario until 1870 (Toronto: University of Toronto Press, 1980).

28. Excluding lumber products, which accounted for 10% of the tolls collected. Cf. McCallum, pp. 66 ff.

29. R.F. Smith, "History and Current Status of Irrigation in Alberta," Canadian Water Resources Journal 3:1 (winter 1978) p. 6.

30. John E. Glenn, "The Role of Government Legislation, Policy and Agency Activity in Irrigation Development: The Cypress Hills Area, 1888- c. 1968," Masters Thesis Geography, University of Calgary, 1968, p. 25.

31. Principle sources for this discussion are R.F. Smith, "Irrigation in Alberta," John E. Glenn, "The Cypress Hills Area," and H.L. Topham, "History of Irrigation in Western Canada," Prairie Farm Rehabilitation Administration, February, 1982.

32. W.A. Adamson, Salmon Fishing in Canada; by a Resident (London, 1860) p. 82.

33. Ibid., p. 21.

34. Ibid., p. 292.

Section 6:
The Twentieth Century

The period from 1900 to 1960 saw the continuation of certain trends established in the nineteenth century. Industrial growth, population expansion, the emergence of the west, urbanization: all of these had their roots in the demographic, economic and territorial expansion of the years 1850 to 1900.

The nineteenth century had also seen the emergence of the Canadian state. From the 1890s onward, the state played an increasingly important role in water development. The period after 1900 saw a multiplication of publicly funded and/or administered projects for hydro-development, navigation, water conservation, recreation, irrigation, drainage and flood control. All three levels of government and a growing number of special agencies became involved with Canada's water resource in the twentieth century.

Beyond this, the twentieth century brought entirely new orders of magnitude to almost every area of water use. Technological advances meant larger dams and more efficient river control; deeper and wider locks accommodated ships with increased carrying capacity, which meant vastly improved navigation; and, perhaps most importantly, a new means of using water to generate energy revolutionized industrial and domestic life. Just as electrically operated machinery improved efficiency and saved money for the industrialist,

electric lighting and appliances improved the home environment and reduced the domestic workload. At the macro-economic level, the development of the energy potential of Canada's rivers involved huge expenditures by both private enterprise and the public sector, and required engineering feats which far surpassed anything imagined in the nineteenth century.

Throughout Canada, the scale and variety of industrial uses for water increased at an unprecedented rate. Pulp and paper, mining, textile manufacture, and the chemical industry were among the fastest growing economic sectors. Each made use of enormous quantities of water. So did the profusion of new municipal water supply and sewerage systems in Canadian cities, and the expanding networks serving older municipalities.

In the west, important cities geared towards servicing the wheat-economy of the surrounding prairie grew up where trading posts had stood a hundred years earlier. Western agriculture was increasingly important to Canada's trans-continental economy. Particularly after the disastrous 1930s, more and more prairie farmers -- often aided by government agencies -- developed water storage facilities for purposes of irrigation. Western towns went to great lengths to secure the water supplies necessary for population growth and industrial development.

Discussion in this section will be organized around four themes. Firstly, the expanding role of the state in water development will be considered, with particular

attention to the multijurisdictional nature of water-management in the twentieth century. Secondly, the emergence of commercially viable hydro-electric power at the turn of the century, and the spread of electrical energy into factories and homes will be examined. A third theme is the expansion of industry -- particularly those industries making abundant use of water. Issues related to water quality will be raised here, although a full discussion of problems associated with modern industrial pollution is impossible. Finally, the emergence of the west as a centre of population and agricultural production, and the special needs of Canada's most water deficient region with respect to irrigation and water supply will be considered.

The State

In a sense, the growth of the state and of state influence in natural resource development embraces all the other trends isolated here. By "the state," I wish to refer to all three levels of government, and to associated public and para-public agencies.[1] The definition is substantially that of Leo Panitch, who suggests that

> . . . the state is not merely the government. The state is a complex of institutions, including government, but also including the bureaucracy (embodied in the civil service as well as in public corporations, central banks, regulatory commissions etc.), the military, the judiciary, representative assemblies and . . . the subcentral levels of government,

> that is, provincial executives, legislatures, and bureaucracies, and municipal government institutions.[2]

The growth of the Canadian state was a key twentieth-century trend and its impact on water-development was not inconsequential. Governments and their agencies proposed and implemented schemes to improve navigation, to develop hydro resources, to protect property owners from flood damage, to drain wetlands, to secure adequate water supplies for urban centres, to protect the resource against waste and pollution, to regulate interjurisdictional conflicts over water use, to develop and maintain recreation sites and to protect fish and wildlife against other (mostly human) water users. The complexity of the problem of water use in the twentieth century is reflected in the multiplication of agencies, commissions, authorities, and departments designed to deal with various aspects of it.

One early piece of Federal legislation -- the Northwest Irrigation Act of 1894 -- has already been discussed in an earlier section. It was suggested that this act established an important principle of Canadian water law: water rights were to be retained by the Crown and were made subject to license and regulation. In 1897, British Columbia defined its water-use policy in an act which incorporated this principle. This law was designed to update and supercede all previous laws "relating to the acquiring of water-rights and Privileges for ordinary domestic, mining and agricultural purposes." It was intended to make "adequate provision for municipal water supply, and for the application of water-power to

industrial and mechanical purposes . . . ." The law also dealt with the "mode of acquisition and enjoyment" of water privileges, and -- importantly for the Provincial treasury -- "the royalties payable to the Crown in respect thereof."[3]

In light of this and similar statutes, it is fair to suggest that the turn of the century marks the beginning of the serious regulation of the water resource by Canadian authorities. British Columbia's dependence on water power in mining, forestry and agriculture led that province to establish a comprehensive set of regulations concerning water-use at an early date.[4] Other provinces followed suit, particularly after the commercial possibilities of hydro-electric development had been demonstrated in the first decade of the twentieth century. Thus, in 1910, the Province of Quebec moved

> . . . to authorize the appointment of a commission to submit rules for the management of running waters . . . [such as] will reconcile the interests of agriculture, of industrial pursuits, and of the forests, with respect for the rights of property.[5]

Similar legislation was passed by Nova Scotia in 1914, by Ontario in 1916, by the Federal government in 1919 (Dominion Water Power Act), and by Saskatchewan and Alberta after they assumed control of their natural resources in 1930. J.H. Corry suggests that in each of these instances,

> . . . an administrative authority was authorized to make regulations governing the use of water, and to supervise and enforce compliance with the regulations.[6]

This sort of legislation reflects a new attitude in the seats of power. It shows a recognition of the fact that water -- like other natural resources -- is part of the public domain, and that its use, particularly for commercial and industrial purposes, has to be supervised and regulated for the common good.

As suggested earlier, the state used its authority (and its taxing powers) to stimulate activity in almost every area of water development in the twentieth century. Exhaustive coverage of these matters is not possible here. But it is relatively simple to isolate a number of areas in which state activity was conspicuous, and to briefly discuss important developments within each area.[7]

The Federal government retains its jurisdiction over inland navigation in Canada to the present day. Twentieth-century initiatives in this field have not always been successful, particularly because of the growing importance of alternative transportation systems -- such as rail, truck and air transport. The importance of a water-route between the Great Lakes and the head of ocean navigation on the St. Lawrence, however, remained an important issue until the completion of the St. Lawrence Seaway in 1959.

At the beginning of the century, it was by no means clear that this seaway would ever be built. An alternative scheme -- involving a deep waterway along the old fur-trade route from the Ottawa River to Georgian Bay -- was proposed by the Federal government in 1904. According to estimates made by the

Department of Public Works in 1908, such a waterway could be built over a period of ten years at a cost of $100,000,000.[8] One perceived advantage of this scheme was that it was an all-Canadian proposal; construction of a similar system along the St. Lawrence route would of necessity involve American participation. But the project was never built; Laurier's government was defeated in 1911 with the Georgian Bay Ship Canal as part of its electoral platform.

Flood control emerged as an area of state intervention in this period. One student of floods and flood control in Canada suggests that the federal interest in the issue was slow to develop because under the British North America Act, "the regulation of natural resource development" was designated as a provincial responsibility.[9] Although the central government may have been slow in developing policies for flood control and relief (at least prior to 1950) the "sub-central levels of government" were actively involved in flood-plain management. An example is the work of the Ontario Conservation Authorities, the first of which was established in 1946. These regional agencies were formed "on the basis of the watershed or drainage area of a stream or group of streams."[10] They set up conservation programs in all fields, and have been involved in channel improvement, the construction of by-pass channels, dikes and flood-walls, as well as in major upstream storage projects which have important recreational, water-supply and wildlife functions in addition to providing flood protection. Ontario Conservation

authorities have received generous support from Federal and Provincial agencies. Four upstream storage reservoirs on the Grand River, for example,were funded on the basis of the following distribution: 37.5% federal; 37.5% provincial; 25% local funds. These reservoirs, the Shand, the Luther, the Conestogo and the Guelph, were constructed between 1942 and 1976.

Public responsibility for flood-control, flood-relief and flood-warning programs made sense politically and economically. One American study -- perhaps oversimplifying -- states the matter in these terms:

> Flood control is instituted for the protection and benefit of the people. These programs are paid for the by people.[11]

The Canadian study cited earlier made a similar point in arguing that "flood losses give rise to recurrent demands for public action."[12] In fact, in most cases where Canadian cities have experienced serious flood damage (e.g. Vancouver, 1948, Winnipeg, 1950, and Toronto, 1954) subsequent and remedial construction programs have been implemented at the public expense.

While public responsibility is an accepted principle, there is today debate over methods of dealing with recurrent flooding. One recent trend is away from structural solutions -- such as dikes and upstream reservoirs -- and towards institutional arrangements. A recent study of flood control on the Grand River takes the following view:

> The flood plain serves a natural function in conveying and storing water during periods of high flow . . . .

> [The] problem relates . . . to the intensive use of flood-prone areas for residential, commercial, industrial, institutional, transportational and agricultural purposes. Thus, the conflict is one of human use versus hydrological use of floodplain land.[13]

From this perspective, the reorganization of land-use in flood-prone areas would be a useful supplement to the structural adjustments which have been used historically.

Conservation more generally has been a concern of the Federal government since 1909. The Canadian Commission of Conservation was active between that year and 1921, when its duties were taken over by regular government departments. The Commission's mandate was to take an inventory of the country's natural resources, to consider questions associated with waste in resource development, to make its information available to the public, and to provide the government with recommendations on these issues. While it was active, the Commission identified four areas in which state action was necessary. Firstly, it recognized the need to impose limits on the exploitation of resources (necessarily a state function since it invovled coercion in the form of licenses, fees and penalties). Secondly, the Commission recommended measures for the restoration of resources which had already been over-exploited. Such measures included reforestation programs and fish-hatcheries. The third area of government action was public education about the country's resources, and the fourth was scientific research. Research was a particularly important area because, in J.H. Corry's terms,

> . . . the will to conserve and the exercise

> of public power to enforce that will, are likely to be misdirected and largely futile in the absence of exact knowledge of what to do.[14]

Municipal governments in this period were primarily concerned with securing adequate water supplies for their industrial and residential needs. Further attention will be paid to this important issue when discussion turns to the expansion of the west as a centre of agricultural production and population in the first half of the twentieth century.

Another area of government activity related to water use in the twentieth century was the regulation of boundary waters. The geographical extent of Canada's water-boundary with the United States has been evoked in a recent study:

> Along the 8,900km (5,500 miles) Canada-United States boundary, 3,900 km (2,400 miles) are formed by boundary waters. Along the remaining, less liquid portion of the boundary, some 90 significant rivers flow across the border . . .[15]

The establishment of an international body to deal with matters related to boundary waters was accomplished in 1909. That year marked the signing of the Boundary Waters Treaty with the United States. Negotiations leading to this treaty took place at a time when several water-related issues were clouding Canadian-American relations. One major problem was the reduction in the levels of the Great Lakes caused by the Chicago Drainage Canal, which diverted water from Lake Michigan in order to flush organic waste from Chicago's meat-packing industry down through the Mississippi system. Other problems concerned developments for purposes of power -- particularly at Niagara

Falls and Sault Ste. Marie -- and for irrigation -- particularly on the St. Mary and Milk rivers on the Alberta / Montana border.

The treaty, which was signed after protracted negotiations, contained general principles for the management of boundary waters. It also established the International Joint Commission, composed of three American and three Canadian members, to administer and enforce the treaty and to arbitrate disputes. This agency is regarded as one of the most successful policy instruments in Canadian water history. In 1958, an authoritative study of the I.J.C. was able to assert that

> . . . For almost half a century, . . . [Canada and the U.S.] have successfully used the International Joint Commission as the instrument for the prevention and settlement of disputes in regard to boundary and trans-boundary waters.[16]

And two Canadian water managers asserted in 1979 that

> Because of the Boundary Waters Treaty and the functioning of the International Joint Commission, it has often been easier to resolve international than interprovincial problems.[17]

Some further attention to the St. Lawrence Seaway seems appropriate, since it was perhaps the single most important water-related project of this period. The Seaway is doubly significant insofar as it exemplifies a new trend in water-development: the emergence of the major multi-purpose project.

The idea of a deep waterway to connect Montreal and the Lakehead was a logical extension of nineteenth century commercial capitalism. Shipping interests believed they could offer cheaper rates on grain transport than the railways with which they competed. But to do so, ocean-going ships drawing twenty to

thirty feet of water had to be able to ascend the St. Lawrence to the Great Lakes ports -- including Chicago, Detroit and Duluth. Montreal "merchants" still coveted the grain traffic of the west, which now constituted a vast, agriculturally productive region which had been largely unsettled in the nineteenth century.

Ironically however it was not western wheat which provided the stimulus for the construction of the Seaway in the 1950s. The economic argument which ultimately brought victory to the pro-seaway forces was that two of Canada's new "staple products" -- iron ore and hydro-electric power -- could be developed more effectively with a deep waterway in place. Iron ore, which had been discovered in abundance in the Quebec - Labrador trough, could be carried by rail to ports on the North Shore of the St. Lawrence, and from there, via the Seaway, to steel mills at Hamilton, Cleveland, Gary and Chicago. The importance of hydro-development to the seaway project is reflected in the fact that $180 million more was spent on hydro facilities than on navigation improvement.[18]

Built with the cooperation of Canadian and American authorities, the seaway provided vastly improved navigation:

> Ships carrying up to 28,000 tons of bulk cargo and vessels carrying up to 9,500 tons of general cargo, provided they did not draw more than 25 feet 6 inches of water, could travel in easy stages from the Port of Montreal to the head of the Great Lakes, over 600 feet above sea level, lifted . . . by massive locks 900 feet long (766 feet of usable length) and 80 feet wide.[19]

As suggested earlier, the seaway combined navigation with other uses -- particularly hydro-electric power generation. The recreation potential offered by power pools such as Lake St. Lawrence, however, has to be weighed against the social costs of this type of wholesale flooding. When in 1958, 20,000 acres of Ontario land were inundated to create this reservoir, 6,500 people living in 8 communities and on 225 farms were forced to evacuate their homes, some of which had been in their families for generations.[20]

Hydro Development

This section serves as a bridge between discussions of the increased importance of the state in water development, and the growth of industry and its use of water in the twentieth century. This is appropriate, since hydro-power was an important area of state-intervention, as well as a crucial factor in Canada's twentieth-century industrialization.

Most Canadian provinces have rivers and streams which are capable of being developed for the purpose of generating electrical energy. In his Presidential address to the Royal Society of Canada in 1899, the engineer T.C. Keefer made substantially this point, if in different terms:

> An examination of any good map of our broad Dominion, reveals, as its most striking feature, an extraordinary wealth and remarkable uninterrupted succession of lakes and rivers, suggestive of ample rainfall, the first great requisite in the occupation of any country. Over a length of several thousand miles, between Labrador and

> Alasksa, and over a width of several hundred miles, there is an almost continuous distribution of lakes; lakelets and rivers; the lakes of varied outlines, dimensions and elevations above sea level, and many possessing facilities for the storage of their flood waters. In many places the outlet from the lake or the connection between a chain of lakes is a narrow cleft in rock where an inexpensive dam will hold back the water supplied by the winter's accumulation of snow.[21]

Development of these "water powers" began in the first decade of the twentieth century. A point made earlier is that individual provinces moved quickly to ensure control over their water resources once the commercial and industrial potential of this new technology had been ascertained.[22] The 1914 Nova Scotia statute cited earlier (page 90) was in fact entitled "An Act respecting the Development of Water Powers within the Province," and was designed primarily to oversee "the flow, the drawing off, the disposal, the distribution, [and] the storage" of Nova Scotia's surface waters.[23] These regulations were necessary because of the technological advances which had made white water an extremely valuable resource, and therefore subject to over-exploitation.

As Keefer suggested, much of Canada's potential hydro-electric power was located on the Laurentian shield. For this reason, and because the story is intrinsically interesting, it is useful to compare and contrast (if only briefly) the histories of hydro-development in Ontario and Québec.

The principle distinction to be made between early hydro development in Ontario and Québec is that while Ontario's

power system developed from the outset as a public utility, the electric industry in Québec was dominated by private corporations until the "Quiet Revolution" of the 1960s. Prior to 1907, water-power sites in Québec were alienated by outright sale, often at very low prices. J.H. Dales suggests that this was because hydro-electric development was still a speculative venture in this early period, insofar as its profitability had not yet been demonstrated.[24] In the Saguenay and St. Maurice basins, important water-power sites were sold to private developers -- such as the Shawiningan Power & Light Co. and the Laurentide Pulp Co. -- for prices ranging from $5,000 for a site at Grand-Mère to $60,000 for the right to generate power at Shawiningan Falls. Dales suggests that

> Similar grants were made on the Upper Ottawa, while lumber interests obtained title to many power properties on the Gatineau and Lièvre rivers, most of these having been used for lumbering purposes for many years previously.[25]

After 1907, power sites were leased, not sold by the Québec government. But private corporations continued to be the main developers. In 1929, 7 large power companies controlled 98% of the developed power in the province.[26]

By way of contrast, the creation of the Ontario Hydro-Electric Commission in 1906-7 by a special act of the provincial legislature marks the beginning of hydro-electric development in Ontario. Ontario Hydro has been called

> . . . one of the world pioneers in large-scale hydro-electric development, standardi-

> zation of equipment and appliances, utility management and rural electrification.[27]

The early development of a provincial hydro-commission allowed

> . . . a small number of municipalities in the western part of the province to cooperate in financing the purchase, transmission, distribution, and sale at cost of electrical energy generated at Niagara Falls, approximately a hundred miles away.[28]

The initial capital of the commission was $2,500,000, and it had built its first transmission line by 1910. The number of municipalities served increased from 12 in 1910 to 130 in 1915. Further expansion brought hydro power to 263 communities in 1920, 436 in 1925 and 550 in 1928.[29] In 1960, Ontario Hydro's fixed capital was $2.5 billion, and its dependable capacity was over 6 million kilowatts.[30]

Ontario's early adoption of the principle of provincially owned electrical utilities set an example which was to be followed by the rest of the provinces as the twentieth century progressed. Once the importance which electric energy would have for the modern economy became apparent, it became essential to standardize power frequencies and to integrate transmission lines, so as to achieve maximum benefit from the resource. This could best be accomplished by a public utility.

Electricity of course, has become an important part of day to day life in Canada in the period since 1900. Early uses were primarily industrial and municipal. Pulp and paper plants in particular were quick to develop the electrical

potential of rivers, especially in Quebec, Ontario, New Brunswick and British Columbia. Ontario Hydro served municipalities whose main concern was with street lighting. It took a long series of technical innovations to turn electrical energy into the familiar, multi-purpose commodity used so extensively by Canadians today.

Industry

It has been suggested that industrial growth was among the most important trends of the first part of the twentieth century. Two historians of the period 1896-1921 offer some statistics which confirm this observation. Between 1900 and 1923, the net value of production in all Canadian manufacturing industries increased from $214 million to $1.3 billion, a six-fold increase.[31] Economic growth would continue in the period under review, although it was to be interrupted by the Depression of the 1930s.

Canadian industrial growth was not limited to any one sector, though certain key industries had emerged by the first decade of the twentieth century. These included wood and wood products (including pulp and paper), minerals (particularly iron), textile manufacture, the chemical industry, rubber products, tobacco, and the boot and shoe industry. In the period 1900 to 1923, the fastest growing manufacturing industries were iron and iron products, for which the net value of production increased from $35 million to $209 million, chemicals and chemical products ($4 million

to $57 million) and electric light and power ($2 million to $67.5 million).[32] Growth in this period was spurred by the rising tide of industrial consolidation (the year 1910 alone saw 22 mergers, capitalized at $157 million) and by the "gradual change from coal and steam power to electricity as the driving force for factory machinery."[33]

Industrialization, as in the nineteenth century, led to intensified urbanization. Between 1891 and 1921 the populations of Canada's two largest cities, Montreal and Toronto, more than doubled. Out west, Winnipeg and Vancouver increased their populations five-fold on the strength of the wheat boom, and other important centres appeared out of nowhere. Early twentieth century cities tended to be a study in contrasts. In Montreal, "the city below the hill" lacked adequate sanitation facilities, hydroelectricity, telephones and other amenities which were commonplace in the wealthier districts on the slopes of Mount Royal. In many industrialized cities, extreme poverty prompted the emergence of municipal reform movements. In Toronto, for example, public health measures were undertaken, including "the establishment of public baths, installation of a sewage treatment plant and a filtration plant and extension of the sewer system."[34]

Canadian industry expanded its already substantial use of water in the twentieth century. The pulp and paper and the mining industries were among the many which depended heavily on hydro-electric power to run their equipment. The

Canadian Department of Mines conducted an inquiry into the "Industrial waters of Canada" between 1934 and 1940. Its conclusions give an impression of the widening scope of industrial water use in twentieth-century Canada:

> Water is the most important of all mineral resources since life cannot, and few industries, if any, can function without its aid. Among its many uses in industry may be mentioned the following: a solvent in chemical processes, such as soap manufacture, dyeing, fermentation, manufacture of sugar, tanning, in the manufacture of textiles, pulp and paper, and in baking; in ore dressing as a vehicle for the conveyance of pulped material; for cleansing; for cooling; for distribution of heat and power, either thermo-dynamic or hydraulic; fire extinguishing 35

The results of these investigations were published in 1942 and constitute a good source for the study of industrial water-use in mid-twentieth century Canada.

The Department of Mines report was directly concerned with the quality of Canadian waters, not because of environmental concerns, but because dissolved or suspended materials in water could cause operating problems for manufacturers and resource extracting industries, thereby increasing production costs.

Interestingly, the authors of this report seem to have anticipated problems which would later be described as acid rain, although they were not concerned with the potential impact on the environment. In a section entitled "Impurities in Natural Waters and their Origin," the report suggests that although rain water is the purest water available,

> . . . many rain water are far from pure . . . Drops of rain falling through the atmosphere absorb matter in amounts depending largely upon the locality and its influence on the purity of the atmosphere. Above large manufacturing areas the air is often laden with dust of all kinds, soot, silica, silicates, sulphates and carbonates, sulphuric and sulphurous acid, hydrogen sulphide, ammonia, organic matter, etc. These are adsorbed in the falling rain or snow, resulting in a very inferior water . . . . Even in places where there is no factory pollution of the air, . . . the rain water shows appreciable amounts of dissolved and adsorbed matter.[36]

Again, the investigators'concern is with the purity of water as it affected manufacturers' interests -- since water with particular characteristics was needed in specific industrial processes -- and not with environmental matters.

Certain industries in the Canadian economy were particularly dependent on the water resource. In the growing chemical industry, water was used in a variety of processes. In the mining industry, enormous quantities of water were used in the ore concentration porcess, as "the main agent for separating the precious metals and the more valuable ores from their gangue." The 1942 report suggested that a single ore concentration plant in western Canada used 3.2 million gallons of water each day. Chemicals added in the flotation process made five-eighths of the water thus withdrawn unfit for re-use, and it was discharged back into the environment.[37]

The pulp and paper industry was one of the country's heaviest water users in this period. Water was used "in the processes for the conveyance and distribution of pulped material, for cleaning, heating and as a solvent." The

purity of the water used was important to the quality of the finished product:

> . . . highly coloured waters . . . impart a yellowish tint to the product. If very white paper is required, the higher price obtained for the product may well pay for the treatment of the process water.[38]

In the textile industry, water was important in the processes of de-gumming, washing and dyeing. Large quantities of water were also used in the production of felt hats, soap, beer and distilled spirits, leather products, sugar, canned and baked goods, starch and glue.[39]

Clearly, water was essential to Canada's industrialization in the twentieth century. In the 1940s, industrial growth meant "progress", and few were yet aware of the ecological threat posed by the industrial use of Canada's water resource. Concerns about water quality were expressed from a utilitarian perspective; acidic water, for example, was only seen as a problem insofar as it might tend to promote corrosion and "acid steam" in manufacturers' boilers.[40] Awareness of the environmental impact of industrial water use has only emerged in the last twenty to thirty years.

The West

Canada's prairie region emerged as an important centre of population and agricultural production in the first quarter of the twentieth century. The basis of the expansion was a single commodity: wheat.

As the prairies filled up with settlers attracted by cheap homesteads and fertile soils, Canadian wheat production and export soared. According to Brown and Cook,

> In 1896 wheat production in Canada stood at 7,855,274 bushels. Five years later it had jumped to 26,117,530 bushels and a further threefold increase had taken place by 1911. Though the 1918 and 1919 crop years were extremely poor, total wheat production had risen to nearly 151 million bushels by 1921.[41]

In order for this type of expansion to occur, western settlers had to overcome problems associated with water supply, both for agricultural and municipal use. In the early settlement phase the shortage of surface water in the prairie region had already become apparent. George Spence suggests that the same was true for ground water supplies:

> In many localities, on the open plains, wells were few and far between. Often, too, when water was struck in deep wells, the water was so highly mineralized as to be unfit for human use, or even for stockwatering purposes.[42]

Despite these problems, the prairie region filled up rapidly, and important cities grew up as service, commercial and manufacturing centres for the prairie wheat economy.

Western cities such as Winnipeg were forced to go to great lengths to secure adequate water supplies for their growing populations. Between 1906 and 1913, the problem of securing a permanent water supply occupied much of the Winnipeg City Council's attention. In 1907, the use of Shoal Lake water was first suggested. This source was considered "excellent . . . for domestic, boiler and general manufacturing

purposes,"[43] but was located some 130 km to the east of the city. The decision to use Shoal Lake required the approval of the Manitoba and Ontario provincial governments, as well as that of the International Joint Commission. This is because Shoal Lake is an arm of the Lake of the Woods, which straddles the Canadian - U.S. border at the junction of Ontario and Manitoba.

The Saskatchewan cities of Regina and Moose Jaw had particularly severe water shortages in the early part of the century. The period between 1917 and 1921 saw drought conditions strike southwestern Saskatchewan and southern Alberta. According to Spence,

> Sizeable lakes and streams went bone dry, shallow wells gradually dried up, and in some districts water had to be hauled in railway tank cars to supply domestic and stockwatering needs.[44]

These conditions brought about efforts on the part of the citizens of Moose Jaw and Regina to secure a reliable water supply, not least as a means of protection against fires. Meetings were held in Moose Jaw in 1919, and representations were made to the Provincial government on behalf of the two major cities and 16 other communities in this water-short region. The substance of the proposals involved the diversion of enough water from the South Saskatchewan River to supply the domestic and agricultural needs of the area. Although a Provincial commission was appointed to investigate the proposed diversion, no action was taken at this time. Development of the South Saskatchewan River for purposes of improved

regional water supply and irrigation would have to wait until the 1960s.

In a drought-prone area such as the prairies, the irrigation of agricultural land is a high priority. Smith's history of irrigation in Alberta traces three distinct pahses in the development of irrigation in the twentieth century. In an initial "commercial phase," lasting from the 1890s to 1915, most irrigation was undertaken on behalf of railway companies which had been given substantial land grants as a means of financing construction of their lines, and which were in a better position to attract settlers (and hence revenue) if their lands were irrigated. The second, or "district" phace is dated from the passing of the Irrigation Districts Act in 1915. This act gave irrigation districts "quasi-municipal powers;" most importantly, it allowed them to issue debentures as a means of financing irrigation works, which were increasing in complexity by this time. In the 1920s and 1930s, only very small irrigation ventures were able to survive without some form of government assistance. Smith dates the third phase of Alberta's irrigation development from the end of World War Two. By this time, irrigation was firmly ensconced as a public responsibility:

> . . . By 1955, all irrigation in Alberta was either administered as irrigation districts or Crown corporations administered by the Province, . . . [except] the Canada Land Project at Vauxhall, which had been taken over by the Federal Government.[45]

In Saskatchewan, early irrigation development developed

more slowly than in Alberta. Part of the reason was that private land development companies were unwilling to invest in the heart of the Palliser triangle. Only a few small irrigation works had been developed in the province prior to the 1930s.

The severe drought and collapsed market conditions of the Depression years took their heaviest toll in the province of Saskatchewan. Accroding to the Rowell-Sirois report, issued in 1940,

> Canada's most serious economic troubles during the thirties had their origin in the impact of the world depression and drought upon the wheat-growing industry of Saskatchewan . . . . The area affected by successive crop failures was about equal to one-quarter of the total improved farm acreage of Canada. It contained nearly one half of the rural inhabitants of Saskatchewan. In 1931, one-half; in 1933-4-6, one-third; and in 1937, two-thirds of the total farm population of the Province was destitute.[46]

In the midst of this calamity, the federal and provincial governments took steps to alleviate its worst effects. The most significant measures -- beyond the short-term relief which enabled the people to survive -- were those which looked towards the reorientation of prairie agriculture. The establishment of the Prairie Farm Rehabilitation Administration by the Dominion government in 1935 was such a measure. The P.F.R.A. was empowered to design and implement programs in three areas -- cultural practice, land utilization and water conservation -- with a view toward preventing the sort of catastrophe that crushed the prairie economy in the thirties.

Acting within its water-conservation mandate, the P.F.R.A. had "provided engineering and financial assistance toward the construction of upwards of fifty thousand small dams and dugouts for the conservation of spring run-off waters" by 1952.[47] In south-west Saskatchewan alone, the P.F.R.A. had developed 26 storage reservoirs and six irrigation projects, serving 9, 310 hectares of hay and fodder crops, at a cost of $4.7 million by 1982.[48] Clearly this type of initiative, while not eliminating the threat of drought on the prairies, can go a long way towards mitigating its effects.

To conclude, the twentieth century has seen a tremendous increase in the scale and complexity of water use in Canada. State agencies have emerged to protect and develop the resource, and to arbitrate disputes between potential users. Industrial uses have multiplied, as have the needs of municipal systems serving vastly expanded communities. Water quality is today threatened by a wide range of pollutants in all regions of Canada. Rivers and streams are diverted, dammed, and otherwise controlled on a huge scale to serve a wide variety of interests, from urban flood control, to irrigation, to hydro-electric development. In the wake of demographic growth, industrialization and urbanization, and territorial expansion, the story of Canadian water has travelled far from its origins in the last Ice Age. The birch canoes and stone fishing weirs of native society, and the simple water mills used by the first European settlers to grind grain and saw boards seem

a long way off indeed. And yet, native peoples still depend on natural regimes and qualities to maintain their traditional economies and lifestyles.

Notes to Section 6

1. Further and more specific attention to developments at the federal level is contained in Section 7.

2. Leo Panitch, "The Role and Nature of the Canadian State," in Panitch, ed., The Canadian State: Political Economy and Political Power (Toronto and Buffalo: University of Toronto Press, 1977) p. 6.

3. Statutes of British Columbia (1897) cap. 190.

4. J.H. Corry, "The Growth of Government Activities since Confederation." Paper prepared for the Royal Commission on Dominion-Provincial Relations (Ottawa, 1939).

5. Statutes of Quebec (1910) cap. 5.

6. Corry, Op. Cit., p. 152.

7. A very conspicuous area of state activity, hydro development, will be considered in a separate section.

8. Canada, Department of Public Works," Georgian Bay Ship Canal: Report upon Survey, with Plans and Estimates of Cost, 1908," (Ottawa, 1909) p. xix.

9. Ian Burton, "Flood Damage Reduction in Canada," Geographical Bulletin 7 (1965) p. 163.

10. Ontario, Ministry of Lands and Forests, Annual Report (1962).

11. L.B. Leopold, T. Maddock, The Flood Control Controversy: Big Dams, Little Dams and Land Management (New York: Ronald Press Co., 1954) p. 95.

12. Burton, Op. Cit., p. 162.

13. Bruce Mitchell et. al., "Physical Adjustments and Institutional Arrangements for the Urban Flood Hazard in the Grand River Watershed, Ontario," Canadian Water Resources Journal 3:2 (1978) p. 35.

14. Corry, Op. Cit., p. 145.

15. James P. Bruce and Frank J. Quinn, "What Difference do Boundaries Make?" Canadian Water Resources Journal 4:3 (1979) p. 5.

16. L.M. Bloomfield, G.F. Fitzgerald, Boundary Waters Problems of Canada and the United States: The IJC, 1912-1958 (Toronto: The Carswell Company Ltd., 1958) pp. iii-iv.

17. Bruce & Quinn, Op. Cit., p. 4.

18. R.E. Richardson et. al., Developing Water Resources: The St. Lawrence Seaway and the Columbia / Peace Power Projects (Toronto: Ryerson / MacLean-Hunter, 1969) pp. 3-4.

19. Ibid., p. 2.

20. Ibid., p. 23.

21. Quoted in H.G. Acres, Water Powers of Canada: The Province of Ontario (Ottawa: Department of the Interior, 1915).

22. As did the Federal Government as regards water powers on Crown lands.

23. Statutes of Nova Scotia (1914) cap. 8. The corresponding Ontario statute, passed in 1916, was entitled, "An Act to regulate the use of the Waters of the Province of Ontario for Power Development purposes." "Power" was defined so as to include "hydraulic, electrical, or pneumatic power or energy." Statutes of Ontario (1916) cap. 21.

24. J.H. Dales, Hydroelectricity and Industrial Development in Quebec, 1898-1940 (Cambridge: Harvard University Press, 1957) p. 30.

25. Ibid., p. 31.

26. G.W. Stephens, The St. Lawrence Waterway Project (Toronto: Warwick Brothers & Ruther, 1930) p. 347.

27. Merrill Denison, The People's Power: The History of Ontario Hydro (Toronto: McClelland & Stewart, 1960) p. 1.

28. Ibid.

29. Stephens, Op. Cit., p. 346.

30. Denison, Op. Cit., p. 2.

31. R.C. Brown and Ramsay Cook, Canada, 1896-1921: A Nation Transformed (Toronto: McClelland and Stewart, 1974) pp. 84-5.

32. Ibid.

33. Ibid., p. 10.

34. Ibid., p. 102.

35. Canada, Department of Mines, "Industrial Waters of Canada: Report on Investigation, 1934-1940" (Ottawa, 1942) p. 33.

36. Ibid., p. 18.

37. Ibid., p. 22.

38. Ibid., p. 24.

39. Ibid., pp. 25-31.

40. Ibid., p. 31.

41. Brown and Cook, Op. Cit., p. 53.

42. George Spence, Survival of a Vision (Ottawa: Department of Agriculture, 1967) p. 15.

43. City of Winnipeg, Brief presented to Inquiry on Federal Water Policy, September 1984.

44. Spence, Op. Cit., p. 43.

45. R.F. Smith, "History and Current Status of Irrigation in Alberta," Canadian Water Resources Journal 3:1 (winter 1978) pp. 10-11.

46. Canada, Report of the Royal Commission on Dominion - Provincial Relations (1940), Book 1, p. 169.

47. Canada, Report of the Royal Commission on the South Saskatchewan River Project (1952) p. 123.

48. H.L. Topham, "History of Irrigation in Western Canada" (Calgary: Prairie Farm Rehabilitiation Administration, 1982) n.p.

Section 7:
The Federal Role: Some Historical Background

Canada's federal government has had an important role to play in the development and regulation of the country's water resources. Even prior to Confederation, the government of the United Canadas took an active part, particularly in the areas of fisheries and navigation. Fisheries was a field where a good deal of state regulation was necessary, since unchecked overfishing could do irreversible damage to an important economic resource -- as it already had in some areas. Accordingly, by the Fisheries Act of 1857, this responsibility was vested in a special fisheries branch of the Department of Crown Lands. By the terms of this act, Fisheries Superintendants were appointed in both Upper and Lower Canada; Overseers of Fisheries also assumed certain administrative functions and a licensing system was adopted. Conditions remained unsatisfactory, however, in the maritime colonies, which were not as yet part of Canada and were not, therefore, affected by the legislation.

The recognition of the need to regulate the fisheries in Canada was in part a product of the advances in scientific knowledge of the later nineteenth century. One source credits a small number of federal civil servants -- experts in their field -- with providing the impetus for the 1857 Fisheries Act: the first substantive effort to offset "the crass spoliation of our great fisheries resource."[1] One such

official was Richard Nettle who drafted the basic Fisheries Act, and who was among the first Canadian scientists to successfully propagate fish under artificial conditions. He wrote widely on fisheries and their conservation, and his 1857 book on the St. Lawrence salmon fishery was particularly influential. Canada's first fish hatchery was probably located in the Crown Lands Department, in a room adjoining his office. The importance of expert scientific advice to federal policy-makers -- in this case as regards the fishery -- had already been established by the 1850s.

Fisheries legislation, of course, did not end with the Act of 1857. After Confederation, a new Department of Marine and Fisheries was constituted at the federal level, and charged with administering the Dominion's responsibilities in fisheries and navigation, as outlined in the B.N.A. Act. The new department consisted of two distinct branches with separate responsibilities, but accountable to a single minister. The fisheries branch was charged with the enforcement of laws with respect to fisheries, while the marine branch had a series of duties related to navigation which will be discussed below. In 1884, these two branches separated, so that a distinct Department of Fisheries existed between 1884 and 1891; in 1892, the departments were again united, for purposes of economy. Two more changes carry this administrative outline through until 1930, when the Fisheries Department Act created a Fisheries Department which was to endure until 1969. In 1914, the fisheries branch was incorporated into the Department of

Naval Service, and in 1921 the old Department of Marine and Fisheries was reconstituted.

What did these various incarnations of a fisheries department (or branch) do? It is clear that the establishment and enforcement of measures for the conservation of the resource was their primary function. J.H. Corry states the matter in broad terms when he suggests that "The Fisheries Act of 1868 provided for a substantial amount of regulation and authorized the appointment of fisheries officers with powers to enforce the legislation."[2] Corry also suggests, however, that early enforcement of the Fisheries Act was lax: something he attributes to a lack of scientific expertise among fisheries officers. In 1892, a scientifically trained Fisheries Commissioner (the post had been created in 1873) was appointed. From this point onward, the knowledge of effective means of conservation, the observed need for strict controls, and the suitability of federal measures increased.[3]

In addition to enforcing regulations and issuing licenses, the federal government became involved in fish replenishment programs in the nineteenth century. Nettle's early fish hatchery has already been referred to. Corry suggests that this type of activity expanded greatly after 1892, largely because of the Commissioner's interest in marine biology. By 1931, there were 23 federally run fish hatcheries in Canada, as well as 9 subsidiary hatcheries and 8 salmon retaining ponds.[4]

In 1889 the fisheries branch took on a further responsibility.

In that year, the Fisheries Intelligence Bureau began collecting and distributing information on fishing conditions across Canada to interested parties. The information was collected at 52 stations across Canada, reported to a central station in Halifax, and distributed from there via telegraph to business centers concerned with fishing.

A final issue concerning the fishery is perhaps the most important in terms of practical public policy. This involves the (historically) ambiguous distribution of power between the federal and provincial levels where this resource is concerned. According to the interpretation of the B.N.A. Act which prevailed in the nineteenth century (1867-1898), "both the regulation and administrative control of all fisheries of the Dominion" was vested in the federal government.[5] Subsequently, however, questions arose as to the Dominion's power to grant exclusive fishing rights in the non-tidal portions of rivers. A decision by the Exchequer Court of Canada determined that the ownership of fisheries in non-tidal waters lay with the riparian owners; provincial governments were therefore able to claim administrative jurisdiction in their respective waters.

These issues -- which represent an early example of federal / provincial conflict over the control of an important resource -- were not resolved in Canada. Three separate court cases were taken to the Privy Council before general principles for the distribution of powers in the administration of the fishery emerged. M.V. Higgins has summarized the results

of this litigation, which took place in 1898, 1912, and 1920. Firstly, the provinces were to retain whatever riparian property rights they held prior to Confederation. Secondly, the federal government was to hold exclusive jurisdiction over a public right of fishery which applied to all tidal waters and, in the case of Québec, all navigable waters accessible by navigation from the sea. Finally, and most importantly from the provinces' perspective, the federal government retained the right of regulation of inland fisheries, but the provinces were granted administrative jurisdiction. J.H. Corry states the situation at the turn of the century in somewhat simpler terms:

> . . . In the meantime, the Dominion lost, through constitutional interpretation, the power to administer and enforce its own regulations over the inland fisheries. The provinces had been much dissatisfied with Dominion administration, which was thought to be wooden and unresponsive to local conditions and needs. Accordingly, when they secured a restrictive interpretation of Dominion powers, they began to move into the field. Not only were they entitled to manage the enforcement of the Dominion regulations respecting inland fisheries, but provincial proprietorship of these fisheries enabled them to establish a variety of regulations of their own . . .[6]

The ambiguity which prevails in current federal / provincial relations over fisheries has its roots in these events. The distinction between regulatory and administrative jurisdiction -- enshrined by the high court in London -- seems arbitrary and impractical. As one historian put it, using a quaint turn of phrase,

> The decision of the Privy Council . . . that the province had proprietary rights in the fisheries, but that the Dominion had legislative jurisdiction, implying power to affect those proprietary rights, and that both authorities had the right to levy a tax or license, made <u>confusion worse confounded</u> . . .[7]

Navigation is another water-related area in which the Canadian central government has played an important role since prior to Confederation. Indeed, the great canal-boom of the 1840s -- though financed by Imperial loans -- was planned and implemented by the Board of Commissioners of Public Works of the United Province of Canada. By 1867, the Board -- which became the Department of Public Works of the United Canadas in 1859 -- had expended approximately twenty million dollars, much of it for the development of the canal system discussed earlier.

The role of the Department of Public Works, especially in the construction of aids to navigation, can now be outlined. Attention will then be turned to the other departments which held responsibility in the area of navigation, namely Fisheries and Marine and Railways and Canals. Finally the water-related activities of the department of the Interior will be examined.

As constituted by a federal act on December 21, 1867 , the Department of Public Works was

> . . . made responsible for all public works not under the supervision of the provinces, such as canals, harbours, construction of lighthouses, military and inter-provincial highways, railways etc. . . .[8]

This was a slight departure from the pre-Confederation situation, since "control of most roads and bridges and certain public buildings" had been transferred to the provinces, and since the department's mandate was now extended to cover works in the maritime provinces.[9] In 1868, administration of harbours, piers, lighthouses, beacons and buoys was taken over by the new Department of Marine and Fisheries, although Public Works retained responsibility for their construction.[10] With the expanded importance of railways in the 1870s, it was seen fit in 1879 to create an embryonic Department of Transport -- known at this stage as the Department of Railways and Canals. Public Works ceded responsibility for the management of canals and related works to the new department at this juncture. As before, however, it maintained responsibility for the construction of such works, and for the important engineering studies and geological surveys which must precede any such construction.

From Confederation to the turn of the century, then, Public Works lost many of its administrative functions to more specialized departments, but retained its role in the area of construction. An outline of the federal administration written in 1914 gave a summary of Public Works' responsibilities. In addition to the construction and maintenance of public buildings, and of telegraph lines on government lands, the department was in charge of

> . . . the plant employed in the construction, improvement and repair of harbours, piers and works for the betterment of navigation . . .[and]

> the slides, dams, piles etc. used for facilitating the transmission of timber . . .[11]

Public Works was one of the five great spending departments of the federal government at the turn of the century.[12] Its total expenditure in 1910, for example, was twelve million dollars, of which the bulk was spent not on major engineering projects, but in small amounts to fill local needs such as the dredging of a harbour or the repair of a wharf.[13] This is not to suggest that Public Works was not still involved in major projects. It certainly was, and several important examples can be cited here. Between 1887 and 1895 Public Works built a lock at the Poupore Rapids on the Lièvre River, an important logging tributary of the Ottawa. The provision of means 'for facilitating the transmission of lumber' was part of the department's mandate, as outlined earlier. The navigation aided by this lock "was naturally confined to tugs and other vessels used for logging" as Robert Leggett wrote in 1976.[14] In 1956, the lock was sold to the James MacLaren Company, a major local paper concern.

On the Red River, the wide variation in stream flow had been the cause of periodic flooding in the City of Winnipeg, the ultimate response to which would be the construction of a floodway around the eastern limits of the city. Navigation as well was adversely affected by the wide variation in water levels. Accordingly, the Federal Department of Public Works constructed "a combined facility including a control dam, a navigation lock, a fishway and a highway bridge."[15] Built

between 1900 and 1916, the facility is known as St. Andrew's lock, and currently accommodates some 1500 small pleasure craft, as well as 300 tugs, barges and larger pleasure craft per year.

Finally, the role of the Department of Public Works in the elaboration of plans for what Leggett calls "the Great Dream" -- the Georgian Bay Ship Canal -- can be mentioned. The main contribution of the department was the detailed survey begun in 1904 and completed in 1908, the report of which is cited elsewhere in this text (section 6, note 8). The survey cost about double the original Parliamentary authorization of $250,000, and demonstrated the feasibility of an Ottawa River - Georgian Bay deep waterway from an engineering perspective. Since the waterway was never built, however, it is difficult to agree with Leggett when he writes, ". . . never was public money better spent."[16]

The twin functions of the Department of Marine and Fisheries, established in 1868, have already been mentioned. As suggested, the marine branch of the department had a series of duties related to navigation in Canada, some of which it had acquired from Public Works. Captain Ernest Chambers has written a history of the department, in which he lists the responsibilities of both branches. Those related to navigation were

> . . . Trinity Houses, Trinity Boards, Pilots, Pilotage, Decayed Pilots' Funds, Beacons, Buoys, Lights and Light-houses and their maintenance, Harbours, Ports, Piers, Wharves, Steamers and Vessels

> belonging to the Government of Canada, except gun-boats and other vessels of war, harbour commissioners, harbour masters . . . and generally such matters as refer to the marine and navigation of Canada.[17]

A similar account is given by Sir Joseph Pope in his discussion of government organization in 1914. This author suggests that in addition to his responsibility for the fisheries,

> . . . the Minister of Marine and Fisheries supervises the construction of lighthouses and fog alarms; maintains lights, buoys and other aids to navigation; regulates marine hospitals, the inspection of steamboats; the examination of masters and mates, pilotage and inquiries into wrecks . . . .[18]

These were important duties in an age when, in certain quarters at least, railways were still considered a supplement to water-based transportation.

The rapid growth of the Department of Marine and Fisheries can be estimated by examining its expenditures over the period 1868-1905. The department spent a total of $371,000 in its initial year of operation, 1868. This sum more than doubled over the next nine years to reach $786,000 in 1879. The increases of the next twenty years were inconsequential, perhaps because of the gains made by rail transport in the period. However the first six years of the twentieth century saw departmental expenditures increase from approximately $[illegible] million in 1900 to $5.7 million in 1905.[19] It is difficult to assess these increases without noting that the years between 1896 and 1911 were years of economic boom in Canada - a boom predicated on the expanding western wheat staple, for which adequate transportation links were essential.

On the issue of harbours, there was occaional friction between local interests and the Department of the Marine, which had been responsible for their maintenance since 1868. According to J.H. Corry,

> In the larger harbours, the older method of administration by local harbour master under the loose supervision of a central department soon gave way to management by a harbour commission composed of local people but directly supervised by the Department of Marine.[20]

In Corry's terms, this system was unsatisfactory from the federal perspective because "local pressures interfered with administration in the national interest." Accordingly, when in 1931 Sir Alexander Gibb investigated the management of harbours on behalf of the Dominion government, he recommended "unified central management of the larger and more important harbours." Following his advice, the government in 1936 placed control of seven of the country's largest harbours under the control of a National Harbours Board. It seems likely that this new agency was created largely in the interests of cost efficiency, particularly given the Depression context. Corry goes so far as to suggest that part of the problem from the federal perspective was that competition between neighbouring harbours led to increased operating and maintenance costs, which had to be borne by the Department of the Marine. Thus, while the centralized harbour authority served to reduce the public expense involved in managing harbours, it was probably less responsive to local needs and concerns -- particularly as regards

competition from American ports -- than the previous system had been.[21]

As already suggested, the new Department of Railways and Canals took over the administration of these transportation links from Public Works in 1879. Little need be said about this agency, except that it was to be responsible for the "control and management of all government railways and canals, and of all works and property appertaining thereto."[22] In 1935, in view of the increased importance of road and air transportation, the department's responsibilities were expanded into these areas, and the name was changed to the Department of Transport.

Finally, it is useful to discuss the role of the Department of the Interior, insofar as its affairs had an impact on Canada's water resource. The Department was constituted by an Act of Parliament passed May 3, 1873, and was charged with administering the affairs of the Northwest Territories, Indian affairs, certain Dominion lands not under the jurisdiction of other departments, and with the ongoing Geological Survey of Canada. In the early years, most of the department's business was with the Indians of the Northwest Territories -- which at this time included Saskatchewan and Alberta. Between 1893 and 1896, however, the department's Irrigation branch made its presence felt; in 1894, for example, matters related to irrigation in the Northwest took up 150 pages of the department's Annual Report.[23] This of course, was because of the discussion and

debate surrounding the passage of the Northwest Irrigation Act in that year. In the previous year, the Irrigation branch had also been prominent. According to one historian of the department,

> In 1893 there was considerable discussion about reclaiming certain arid portions of the Northwest Territories by construction of a system of irrigation canals. The Northwest Irrigation Act was passed in 1894, and thus we have the origin of what is now [1963] the Water Resources Branch [of the Department of Northern Affairs and National Resources].[24]

The irrigation sector of the Department of the Interior was not always a distinct branch. Prior to 1912, it had been affiliated with the department's forestry service; after a brief interlude as a separate branch, Irrigation was absorbed by a new "Reclamation Service" in 1918. In 1912, another water-related function was assumed by the department when a Water Power branch was created.

Throughout its history, the Department of the Interior was important to the development of Western Canada, not least because of its role in irrigation and other water-related serveces. This importance continued after 1936, when Interior -- along with Mines, Indian Affairs, and Immigration -- was absorbed by the new Department of Mines and Resources.

As a postscript, a brief sketch of the history of federally administered hydrographic surveys can be given. Prior to 1904, such surveys had been conducted by a number of departments to serve particular needs. Most important in this respect were Public Works and Railways and Canals.

After 1904, this branch of the public service was assigned to the Department of Marine and Fisheries, "so as to systematize and facilitate the work in connection with the hydrographic surveys."[25] In 1936, responsibility for these surveys was assumed by the new Department of Mines and Resources.

Notes to Section 7

1. J.E. Hodgetts, Pioneer Public Service: An Administrative History of the United Canadas, 1841-1867 (Toronto: University of Toronto Press, 1955) p. 172.

2. J.H. Corry, Op. Cit., p. 146.

3. Ibid., p. 147.

4. M.V. Higgins, Canadian Government Publications: A Manual for Librarians, 1867-1931, p. 457.

5. Ibid., p. 456.

6. Corry, Op. Cit., p. 147. My emphasis.

7. Adam Shortt ed., Canada and its Provinces (1914) vol. 9, p. 251. My emphasis.

8. M.V. Higgins, Op. Cit., p. 8.

9. B. Hallett, comp., Records of the Department of Public Works (Ottawa: Public Archives of Canada, 1977) p. 1.

10. Ibid., p. 2.

11. Sir Joseph Pope, The Federal Government (Toronto: Glasgow, Brook & Company, 1914) p. 325.

12. The other four were Railways & Canals, Militia, Marine & Fisheries, and Naval Service.

13. Pope, Op. Cit., pp. 325-6.

14. Robert F. Leggett, Canals of Canada (Vancouver: Douglas, David & Charles Ltd., 1976) p. 103.

15. Ibid., pp. 105-6.

16. Ibid., p. 122.

17. Captain E.J. Chambers, The Canadian Marine: A History of the Department of Marine and Fisheries (Ottawa, 1905) p. 33. A Trinity house was a sort of fraternity or guild of masters and seamen who were responsible for lighthouses, buoys etc. prior to the assumption of these functions by the state.

18. Pope, Op. Cit., p. 377.

19. Chambers, Op. Cit., p. 33.

20. Corry, Op. Cit., p. 126.

21. Ibid., pp. 126-7.

22. Pope, Op. Cit., p. 327.

23. R.T. Flanagan, "A History of the Department of Northern Affairs and National Resources . . ." (Ottawa: Department of Northern Affairs and National Resources, 1963) p. 19.

24. Ibid., p. 19.

25. Chambers, Op. Cit., p. 58.

Conclusion

Any attempt to write the history of water in Canada must of necessity be partial and incomplete, unless the author aspires to be an encyclopedist. Even to simply enumerate the various uses of water as they evolved through time is an enormous task. Modern experts are able to define water as natural resource, chemical compound, and economic good, and to subdivide its uses according to an elaborate analytical grid. Each definition, each use of water that can be thus isolated has its own distinct history -- in most cases a history waiting to be written. For this reason, some very general conclusions are all that can be hoped for.

In general, it is clear enough that water has always been vital to human survival. Native societies have always relied on the streams that crossed their land as sources of food and drink and as a medium of transport. Early settlers added the provision of a motive force for grinding, sawing and other mechanical functions to this list of uses. In the nineteenth century, while western traders continued to use Canada's rivers to seek out new sources of fur, eastern industrialists expanded their productive capacity by applying water-power to various stages of the manufacturing process.

Traders and manufacturers, however, should perhaps not be mentioned in the same breath as Natives and settlers. Certainly the westward drive for new sources of beaver-fur

(and the concomitant exploitation of the material needs of Native peoples) and the mechanization of the manufacturing process (implying the destruction of the artisanal mode of production) are phenomena which are only very remotely related to the exigencies of human survival. In both cases, water intervened as a technical support to ventures in which economic profits were the real concern.

Perhaps the distinction between water-use for survival, and water-use for profit is one which should figure prominently in future water policies. Certainly Native societies have good reason to protest against the multiple threats to their way of life posed by huge dams built to provide cheap power for the North American consumer society, by industrial effluents which contaminate their food supply, and by a whole range of environmental problems caused by technologies whose main purpose is to increase the standard of living of the majority. Care should be taken to balance the economic benefits of increased and more complex water use against the objective needs of Native peoples.

Even more generally, the urge to make a profit from a resource such as water should be balanced against the need to preserve it for future generations. Canada is a water-rich nation, but poor management of resources can strain the circumstances of even the wealthiest society. Canadian federal water policy should be designed, above all, to address these concerns.

APPENDIX I

Terms of Reference

Objective

To provide a broad narritive or essay on the history of water uses and developments in Canada, with special reference to the role of the federal government in those developments.

Tasks

1. Review the history of water uses from pre-European to modern times, giving balanced treatment to different uses (navigation, fisheries, energy, industrial, agricultural, domestic, recreational) and to different regions of the country.

2. Describe the role of governments in major undertakings (e.g. Rideau, St. Lawrence canals, irrigation surveys, treaty negotiations), especially the policies of the federal government in supporting water-related developments and co-operative programs.